Late Pleistocene Archaeology & Ecology in the Far Northeast

Edited by Claude Chapdelaine

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Edited by Claude Chapdelaine • *Foreword by* Christopher Ellis

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CONTENTS

FIGURES

TABLES

FOREWORD

I am very pleased to provide some comments that can serve as a brief preview of this fine collection of studies pertaining to the earliest known human occupants of the Far Northeast (northern New England and adjacent area of Canada). The volume brings together several up-to-date regional data syntheses, for which there is always a need (and especially in these days when many discoveries can remain hidden in gray CRM or planning literature or deep in the bowels of small museum collections), as well as specialized studies that address several mostly well-known problems pertaining to the age, geological and paleoenvironmental context, and subsistence practices of these early peoples. I am especially happy to see the results of CRM work being published (e.g., Boisvert, Spiess et al., this volume) and the increasing involvement of local Native communities in exploring, managing, and protecting cultural resources (Rosenmeier et al., this volume).

Throughout the volume, progress is evident on several other fronts: to name but a few examples, identifying stone raw material sources (Boisvert), isolating potential routes of entry or migration into the area (Lothrop and Bradley), explaining site formation processes (Courchesne et al.), documenting and understanding site layouts and the spatial organization of activities (Chapdelaine; Rosenmeier et al.), and determining the particular geographic settings that were being sought for occupation (Crock and Robinson; Spiess et al.). Even more basic, and with Maine leading the way in discoveries, the syntheses show that the number of actual sites reported has grown exponentially and puts to shame the recent efforts in areas where I have worked, notably the central to eastern Great Lakes, where work has tailed off somewhat since the heady days of the 1970s and 1980s. Although several new sites have been discovered through CRM activities in Ontario, unlike the Far Northeast there has been little effort to publish that work (although there are exceptions such as Woodley [2004]).

The number of finds is even more remarkable when one considers that unlike the eastern Great Lakes—which are today densely populated, heavily developed, and under intense cultivation—much of the Far Northeast is rugged and forested with much lower density populations and much less modern development. Combined with the fact that finding any of these rare early sites is difficult, literally like finding a needle in a haystack, locating even one site in this landscape is exceedingly difficult, although like Claude Chapdelaine (this volume) one can be extremely lucky. Clearly we are way beyond the situation in the 1970s when only a handful of Far Northeast sites—such as Debert, Nova Scotia (MacDonald 1968), Bull Brook, Massachusetts (Byers 1953), and Reagen, Vermont (Ritchie 1953)—were known or widely reported. And, as other recent publications (e.g., Robinson et al. 2009) and the chapters in this volume by Rosenmeier et al., Crock and F. Robinson, and Brian Robinson make abundantly clear, there are still many things we can learn about even those long-known sites.

The syntheses presented here also confirm earlier suggestions, going back to at least Spiess and Wilson's (1987:129–155) conception of a "New England–Maritimes Paleoindian Region," that the Far Northeast is distinctive in the earlier time periods and notably in relation to the areas I know best just to the west. Evidence of this distinctiveness has been somewhat clear from near the beginning, such as in the presence of deeply indented-base fluted points from sites like Debert, and the more recent work reported here only serves to confirm these differences and highlight more of them. To be sure, there are echoes of similarity that have to indicate a common origin and some degree of interaction between these two areas: the presence of the ultra-thin Crowfield type fluted points (Deller and Ellis 1984), well known in southern Ontario, at sites like Reagan, or even the recovery from Quebec's first reported fluted point site (Cliche-Rancourt: Chapdelaine, this volume) of a single example of the rare but distinctive large alternately beveled bifaces/knives reported from several Ontario sites (Ellis and

Deller 1988). Also, and similar to the Great Lakes case, material from a limited range of distinctive stone sources shows up time and again on Far Northeast sites, often in considerable quantities and at long distances (250–300+ km) from their origin points (e.g., Burke 2006, and several chapters herein).

These patterns do indicate that high settlement mobility and widespread social interaction networks were held in common in the two areas, albeit using different raw material sources, but in my opinion the reasons behind Paleoindian raw material choices still remain obscure (Ellis 2002). In any case, I am more impressed with the differences. In comparing the Paleoindian occupation between the two areas I am reminded very much of Douglas Byers (1959:254) great analogy in his discussion of the Eastern Archaic: "All show points in common. They are as familiar as a contemporary class picture from another school—the clothes and poses are familiar, but the faces are different." Notable differences extend from the distinct Far Northeast point forms such as the Ste. Anne, Cormier/Nicholas, and aforementioned Debert style to the common presence in the earlier components of twist drills, pièces esquillées, and the like.

It is plausible that the toolkit differences are to some extent explained by geographic isolation and consequently more limited east-to-west interaction patterns, perhaps due to the presence of physical geographic barriers such as the Champlain Sea, differences reinforced by the fact that little in the way of certain stone raw materials shows up in both areas—although the location of sites throughout the area, as along the north shore of the St. Lawrence, certainly indicates that Paleoindians had watercraft. It is also plausible that these and other contrasts indicate differing adaptations in the two areas. Certainly, as the chapters in this volume clearly demonstrate, these early inhabitants of the Far Northeast were living in an area that contrasted in several respects with the Great Lakes. In some locations such as southern Quebec and the Canadian Maritimes, all evidence suggests to me that these peoples were living in true tundra environments at the northern edge of the area closer to the ice sheet; in Ontario the evidence still suggests that Paleoindians avoided those areas (Ellis 2002). They also, as the Rosenmeier et al. chapter in this volume makes abundantly clear, had to cope in at least part of the region with rapid and substantial environmental changes induced by the Younger Dryas climatic event, which apparently had more limited and less rapidly appearing consequences for Paleoindian peoples living elsewhere (Meltzer and Holliday 2010)—including, although the exact extent of the effects is disputed, the Great Lakes (Ellis et al. 2011; Eren 2009).

Several authors in this volume also suggest that these peoples were able to, and were, exploiting marine resources of the Champlain Sea, the lower reaches of the St. Lawrence River area, and, one presumes, the Atlantic coast. I remember being exposed to this idea by my first mentor, the late William Roosa, who talked of the possibility that the inhabitants of Bull Brook, Massachusetts, were hunting seals (he even suggested this in print: Roosa [1962:265]), but I was highly skeptical of this idea at the time. Later investigators also began to raise this possibility (e.g., Keenlyside 1985:83–84). Although I would certainly love to see direct faunal evidence, I believe this idea is now on a much more plausible footing based on improved dating of the Champlain Sea, which makes it definitely contemporary with the Paleoindian occupation, and the recent models of the geographic and geological settings of the sites reported in this volume, notably at locations in Vermont and Quebec.

Such a unique set for resources should have had an effect on overall site locational preferences. In fact, I wonder if the ability and willingness to inhabit the more extreme environments or tundra areas closer to the ice sheets in the Far Northeast, but seemingly not in the Great Lakes, were due to the fact the far northeastern peoples could also access resources unavailable to the west, such as the marine resources. A greater abundance of resources might also explain why anyone entering the area from warmer, more southern climes would be attracted to these areas in the first place. The rarity of these early sites suggests that it was not population pressure that forced people into new, previously uninhabited, more marginal areas; unless one wants to assume that Paleoindian peoples simply had a wanderlust to explore new places (and they may have!), there had to be some attraction of these difficult-to-traverse areas with their extreme climates and lower inland carrying capacities. Researchers should be able to build on the foundation provided by the contributions to this volume to explore these kinds of ideas in more detail in future studies.

It is fair to note that some questions remain partly unanswered or controversial. I am certainly saying nothing

new here, for the same problems have been noted in commentaries in Paleoindian volumes and syntheses since archaeological time immemorial (e.g., MacDonald 1971; Mason 1962; Wright 1989). One obvious one, hinted above, is the paucity of preserved faunal (and floral) remains. As is evident in this volume (e.g., F. Robinson; B. Robinson), the subsistence models we are currently developing and using, especially those concerning the role of caribou, are much more sophisticated than the simplistic, and rightly criticized (e.g., Dincauze 1988), models of the past that drew one to one analogies with whatever particular ethnographic group happened to strike one's fancy. Nevertheless, although they may be more sophisticated and realistic, in the absence of substantial faunal recoveries the new models remain simply well-informed models.

Another notable problem area revolves around questions concerning the absolute age of the sites, refined knowledge of which is basic to almost all archaeological interpretations. I used to think that we had a substantial foundation for our absolute age estimates of these occupations and especially when we had sites like Debert, with many fairly consistent radiocarbon dates; this suite of dates seemed to indicate that it was the best absolute-dated Paleoindian site in the East (e.g., Curran 1996:5–6; Ellis 2004). However, as Rosenmeier et al. suggest in this volume, even the best dated actually may not be well dated, or, at least, there are several ways one can interpret the dates—and I believe the situation may be even more complicated than how they portray it. Of course, part of the problem is that radiocarbon dates during the late Pleistocene, and Younger Dryas in particular, vary because of changes in atmospheric carbon, and radiocarbon dates of the statistically same age may actually be separated by hundreds of sidereal years ("radiocarbon plateaus"). One can even get reversals at some points such that one gets older radiocarbon dates on what are actually younger sites (e.g., Curran 1996; Fiedel 1999). I am convinced, for example, that plateau effects account for the fact that we seem to have a huge number of distinct point types (Bull Brook/West Athens Hill, Michaud/Neponset, Crowfield, Cormier/Nicholas) wedged into a narrow slice of radiocarbon time around 10,500–10,100 ^{14}C yr BP. We need to be exceedingly careful in how we treat and use those dates, and we need to supplement them with other lines of evidence. This volume does shows that efforts to use the other lines of evidence are well under way, most notably via geochronological techniques and especially the distribution of sites in relation to old levels of the Champlain Sea and the upper St. Lawrence River area (Pintal, F. Robinson, this volume), and through the continuing development and use of refined point typologies (Lothrop and Bradley, Spiess et al., this volume).

Well, all we can do is keep plugging away and hoping we find those Holy Grail sites with preserved fauna and flora, including charcoal suitable for dating, in undisturbed contexts. I am also hopeful that eventually we will begin to construct models and accumulate information that helps us to go beyond the more materialistic and pragmatic concerns of Paleoindian life such as subsistence practices. Perhaps, as Jess Robinson hints in his chapter, we may be able to one day speak of ideological aspects of Paleoindian peoples, of aspects such as their cosmological landscapes and how these perceptions may have influenced the colonization process and their use of space, a topic I find particularly fascinating, albeit difficult to deal with (Ellis 2009). Regardless, as this volume makes abundantly clear, studies in the Far Northeast have come a long way even over the scholarly lifespan of this researcher, and I look forward to continuing progress in the coming decades.

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Paleoindian archaeology calls for a multidisciplinary approach, and most scholars work with a broad geographic scale to coincide with the adaptive nature of the late Ice Age hunting groups they study. Today's borders in the Far Northeast lose their significance in the face of the high mobility of these Paleoindian groups, which is visible in the long distances between sites and the primary lithic sources and is best illustrated by the use of Munsugun chert from northeastern Maine at the Bull Brook site in Massachusetts. It may be said that scholars working in the Far Northeast form a large family and that sharing information is rarely a problem. As an example, in 2002, while I was starting a long-term project in the Mégantic Lake area, Richard Boisvert paid me a visit and, after looking at the few tools and flakes from the Cliche-Rancourt site, told me with a wide smile that I might have a very early site. Over several years, he had encountered Early Paleoindian sites with a striking feature that he recognized at Cliche-Rancourt in 2002: the combined presence of New Hampshire rhyolite and red Munsungun chert. I already knew about the latter lithic source, but I did not know about the rhyolite from Jefferson or Mount Jasper. Dr. Boisvert's sixth sense turned out to be right, for we found the first two of our fluted point fragments the following year.

Collaboration was instrumental in the initial stages of our work at Mégantic Lake, as it is now with this book. I would like to acknowledge all the contributors of this book. They are not just active in the field and at meetings; they are also willing to use their precious free time to produce knowledge in published form. It is time-consuming labor, taking a good share of our energy, but we all know that written words endure longer than pretty talks enhanced by witty one-liners. My sincere thanks go also to Christopher Ellis, who enthusiastically accepted the request to write a foreword to this volume. As a veteran of Great Lakes Paleoindian studies, he was indeed a good choice, and his ability to accomplish this task in timely fashion is equal to his great generosity and willingness to share data with the Far Northeast family. Along with Kurt Carr, Dr. Ellis also acted as a reviewer, and their comments helped to broaden the scope of this book. They are both acknowledged here for the high quality of their constructive comments.

This volume can be considered as the official admission of the province of Quebec to the unofficial "Clovis Club," a lofty claim that requires some background. When I was dreaming about finding the first Early Paleoindian site in Quebec back in the early 1980s, I had the opportunity to dig one long weekend with Michael Gramly at the Vail site in Maine, near the Quebec border. Accompanied by David Keenlyside of the National Museum of Canada (now the Canadian Museum of Civilization), we uncovered a nice endscraper and several flakes while having the pleasure of working on this famous site. After that experience, I asked Mike if he would be interested in publishing in French, since he had new data collected after his 1982 publication. He accepted, and I seized the opportunity to look at the whole Paleoindian situation in southern Quebec, basically to ask geographers to contribute to the physical and biological environment, to discuss the potential of finding fluted point sites, and to examine new data from late Paleoindian sites. Following the publication of this special issue of *Recherches amérindiennes au Québec* in 1985, the late Pierre Dumais organized another issue in 2002 in the same journal on Paleoindian questions from southern Ontario, the Maine-Maritime peninsula, and Quebec. The following year we found the first fluted point site in all of Quebec. I freely admit that this discovery was an archaeologist's dream come true. However, it would have been impossible without the consent of M. Jean Cliche and Mme Catherine Rancourt, who let us invade their property and run our summer field school from 2001 to 2009. Their generosity is equal to the support they have given us all these years,

and we will be working on the Cliche-Rancourt site for some time to come, combining small-scale research with the challenge of developing an interpretation center.

This volume is in part the result of the long-term collaboration between myself, during a sabbatical leave from the Université de Montréal, and Richard Boisvert, New Hampshire State archaeologist, who came to the Mégantic Lake area almost every year with a group of volunteers to assist in various research aspects. It was Dr. Boisvert who made the suggestion to submit our manuscript to the Center for the Study of the First Americans. Given the reputation of this institution over the past twenty years, it was our idea to find a western publisher to build a more continental audience for Far Northeast archaeology and ecology. I thank series editor Michael Waters for his immediate enthusiasm for the project, and my gratitude also goes to Mary Lenn Dixon of Texas A&M University Press for having supported this venture through all the stages leading to publication. I hope that scholars working on the Paleoindian era in North America, and elsewhere, will find an interest in the diversity of these chapters on the Far Northeast.

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CHAPTER 1

Introduction

Toward the Consolidation of a Cultural and Environmental Framework

Claude Chapdelaine and Richard A. Boisvert

The concept for *Late Pleistocene Archaeology and Ecology in the Far Northeast* derives from a long-term collaboration between the two of us and the desire to share the results of the past decade or so of research by the many active scholars addressing the Paleoindian era in this region. The Far Northeast is not a new concept (Sanger and Renouf 2006); it refers to a large glaciated territory that holds a particular geographic and ecological position, affording it a distinct chapter in the peopling of North America. The Far Northeast is a peninsula incorporating the six New England states, New York east of the Hudson, Quebec south of the St. Lawrence River and Gulf of St. Lawrence, plus the Maritime Provinces. This region was inhospitable before 13,500 years ago, especially in its northern latitudes. The fundamental issue for this volume focuses on the derivation of the Clovis pioneers from their eastward migration into the Far Northeast, who were distinguished by the more numerous fluted point style form variations than previously thought (Bradley et al. 2008; Morrow and Morrow 1999, 2002).

The archaeological record of the Far Northeast indicates that the area was probably settled slightly after 13,000 years ago. Several sites might apply to be among the oldest sites, but decisive data based on secure radiocarbon dates are still lacking (Bonnichsen and Will 1999; Gramly and Funk 1990). The contenders, on a logical basis, should be found in the western or southwestern portion of the Far Northeast. Sites such as Bull Brook in Massachusetts, Whipple in New Hampshire, or several sites in southeastern New York were certainly among the early settlements. Although all these sites are not well dated independently with firm radiocarbon assays, the fluted point styles from these sites are close to the older Clovis prototype that was the trademark between 13,500 and 12,800 years ago farther west and south.

No clear association between the extinct fauna and human occupation has been recorded in the Far Northeast, for few bones have been recovered so far. Although the proposition may seem tedious, caribou does seem to be the major prey, leading the majority of scholars to favor the caribou/tundra model of settlement subsistence during the early days and in northern latitudes. Within this perspective, the Vail site in Maine illustrates the Paleoindian capacity to explore and exploit a mountainous area around 12,500 years ago (Gramly 1982), and Debert in Nova Scotia (MacDonald 1968), dated to the same time range, could be the illustration of swift eastward mobility by Paleoindian hunters in relation to extensive caribou migration along a northeastern corridor.

The incentive of this book is to present new data and updates of some earlier interpretations. Among these, it is worth mentioning the synthesis provided for the early 1990s (Gramly and Funk 1990), revisited by others eight years later (Spiess et al. 1998; see also Spiess and Newby 2002). A lengthy foreword by the late James Petersen (2004) on the West Athens Hill Site, the Paleoindian period, and the contributions of Robert Funk is also of great relevance to grasp the accumulated knowledge on this early period of time. Still, there has not been a single book or article that makes a complete summary of the Paleoindian era for most of the Far Northeast. With this volume we attempt to address this need, admitting that our coverage is by no means complete. Of the Canadian provinces, New Brunswick and Prince Edward Island are not represented in this volume, since no discoveries have been made in the past decade although early human presence has been recorded previously (Keenlyside 1991).

This book offers a new opportunity to review new data and interpretations in most areas of the Far Northeast, including a first glimpse at the only known fluted point site in Quebec, the Cliche-Rancourt site. Given the annual investigation of sites throughout the Far Northeast, the accumulation of research findings has been steady, making it timely to present some of the most interesting results, changing our perception of this large area.

The process of assembling this volume began when scholars were invited to participate in a symposium at the annual meeting of the Quebec Archaeological Association in Sherbrooke, May 1–3, 2009. All nine participants involved in Paleoindian archaeology or ecology agreed to transform their presentations into chapters for the present book.[1] After the Sherbrooke meeting, invitations were extended to additional colleagues who could fill key areas of the Far Northeast. The famous Debert site is now part of a cluster of sites, and a team led by Leah Rosenmeier agreed to contribute to this venture. Likewise, John Crock accepted our invitation to present an update on the Early Paleoindian occupation for the state of Vermont. A total of ten chapters along with this introduction are thus presented here, each presenting new data to the scientific community.

Each chapter is unique, ranging from site description (Chapdelaine) to site clusters (Rosenmeier et al., Spiess et al., Pintal), pedology (Courchesne et al.), subregional synthesis (Boisvert, Crock and F. Robinson, Lothrop and Bradley), and specific problems such as the relationship with the Champlain Sea (F. Robinson) and the existence of a caribou drive near the Bull Brook Site (B. Robinson). With reports incorporating Maine, New Hampshire, Vermont, eastern New York, Massachusetts, southeastern Quebec, and Nova Scotia, we feel that our coverage of the Far Northeast is adequate and hope that our efforts provide food for thought and stimulate a new interest in areas where archaeological research is lacking.

A collection of chapters covering such a vast territory could only be eclectic, which was the case for a comparable book on the Southeast (Anderson and Sassaman 1996), and we feel it is logical to present the regional syntheses first (part I), followed by specialized studies (part II).

Chapter 2, by Jonathan Lothrop and James Bradley on the Hudson Valley, covers the presumed territory from which specific groups may have entered the Far Northeast from the west, not excluding a southern entrance, and it might contain the most ancient sites of our study area. This chapter presents recent data and interpretations on Early and Middle Paleoindian lifeways during the late Pleistocene in the Mohawk/Hudson drainage basin. It provides current perspectives on late Pleistocene landscapes of eastern New York, scenarios for human colonization, and aspects of settlement, subsistence adaptations, and technology. It is thus a starting chapter for studying the peopling of the Far Northeast.

The state of Vermont was first in the Far Northeast to record a Paleoindian site, with the Reagan site (Ritchie 1953), but a long silence followed that is now broken by John Crock and Francis Robinson reporting an impressive set of new sites. In chapter 3 they challenge stereotypes by referring to Paleoindians located mostly along the Champlain Lake area as "Maritime Mountaineers" inhabiting the west coast of New England. A strong link can be made between their vision and the one developed by Pintal's chapter 11 on the Quebec Strait, emphasizing both an intimate relation between a site's location and the Champlain Sea episode with its presumed marine biodiversity. This welcome chapter describes the cultural affiliation, settlement type, content, and location of twenty-five recorded Paleo-

indian sites and well-documented finds in Vermont for the purposes of understanding human colonization and early settlement in the region.

The state of New Hampshire has also known a rapid increase in Paleoindian sites over the past fifteen years, and the synthesis provided by Richard Boisvert in chapter 4 is the first ever attempted while fieldwork and lab analysis are ongoing. It is thus not surprising that research conducted since 1996 has substantially enlarged the database for the state and contributed significantly to the region. This expansion is summarized and evaluated in this chapter. Patterns of site location within the state, evidence for behavior beyond the requirements of hunting, and indications of complex interactions with other areas lead Boisvert to a more nuanced model of settlement. The Potter site, which is mentioned in the chapter, is definitely a key site, and much attention will be devoted to it in the coming years.

The state of Maine has been making tremendous progress since the discovery and publication of the Vail site in the early 1980s (Gramly 1982). In chapter 5, Arthur Spiess and his colleagues Ellen Cowie and Robert Bartone bring us to another level with an analysis of clusters. The authors mention the discovery of almost twenty Paleoindian sites in Maine in the past twenty years. Two clusters are discussed in this chapter: Vail, and those associated with the Lewiston-Auburn airport. Styles of fluted points and range of raw materials used among various sites in a site cluster are examined to discuss the length of occupation and the range and variation in Paleoindian movement to and from each place. The seasonal aspect of Paleoindian settlement pattern is supported by this new recognition of successive occupations at specific areas. With this perspective in mind, several sites considered isolated in an area might be the start of new research to verify the existence of a cluster.

A new contribution on a cluster of sites in the general area of the Debert site by a team of scholars led by Leah Morine Rosenmeier starts part II and the specialized studies. With the support of Scott Buchanan, Ralph Stea, and Gordon Brewster, in chapter 6 Rosenmeier presents new evidence from several sites on soil, stratigraphy, and cultural content and discusses the implications on the dating and environmental conditions prevailing at the end of the Pleistocene. These new sites define a cluster that gives the region a new window into the past.

The Cliche-Rancourt site reported in chapter 7 by Claude Chapdelaine is the single known site for the entire province of Quebec that could be assigned to the Early Paleoindian period on the basis of fluted points and other distinctive artifacts. The site has received much attention since 2003, after the first two fluted points were discovered, and 205 m^2 have been dug so far. Four loci were delimited and extensive research has been carried out on Areas 1, 2, and 3. The 2009 field season confirmed that Area 4 was not occupied by fluted point makers, but the recognition of the new Area 5 in the southwestern portion of the site has given new breath for investigation. The chapter is limited to a detailed presentation of the first three areas. The tool assemblage is described, followed by a discussion on internal organization and domestic activities. External relations with adjacent regions are explored within a broader perspective with the implications of the Cliche-Rancourt site for our understanding of seasonal movements, adaptation, lithic acquisition, and cultural relations.

The unusual presence of artifacts at depths ranging from 20 to 80 cm within the otherwise sterile orange sand layer below the spodic gray sand at Cliche-Rancourt led to the collaboration of François Courchesne, pedologist, and his team to tackle this problem. The results of this study, given in chapter 8, question the mechanisms involved in this burying process. A polygenetic model of soil evolution was used as the theoretical framework to facilitate the identification work of pedogenetic processes, in particular, pedoturbation. This approach has helped to retrace the soil evolution since ice retreat and suggested the central importance of cryoturbation and bioturbation as major mechanisms in the burying of artifacts at the Cliche-Rancourt archaeological site.

Chapter 9, on Bull Brook, by Brian Robinson is part of a quest to understand a settlement pattern represented by a single organized event with thirty-six activity loci, along with the economic strategy to allow this important social aggregation. The hypothesis developed here stresses the importance of a lowstand of the changing sea level east of Bull Brook, favoring the emergence of Jeffreys Ledge, a drowned maritime island that may have provided abun-

dance, predictability, and landscape characteristics suitable for communal caribou drives. The location of Bull Brook could have been related to this late ephemeral Pleistocene landscape.

Chapter 10, by Francis Robinson IV, on Vermont is a much needed update on the exact relationship between the Champlain Sea episode and the known Paleoindian sites. The location of the Reagen site, a multicomponent Paleoindian site, near the expected sea shoreline or altitude tends to support the chronological framework based on fluted point forms developed recently (Bradley et al. 2008). Models of the inception and duration of the Champlain Sea have been revised significantly over the past decade, and the Paleoindian presence in Vermont is now considered coeval. The biodiversity of the late Pleistocene body of water brings a new perspective to discussions of Paleoindian settlement patterns and subsistence dominated by the caribou model.

In chapter 11, Jean-Yves Pintal presents a series of challenging sites found in the Quebec City area that are providing us with a unique view of the end of fluted point manufacture and its transition into something else. The inception and evolution of the Champlain Sea episode in the Strait of Quebec are the necessary general background for understanding human occupations in the area. The basic chronology suffers from a lack of radiocarbon dates for these oldest sites, but an Early Archaic site dated to 9000 ^{14}C yr BP with a quartz assemblage is providing a solid upper limit for the Paleoindian period. The tool assemblage of these oldest sites in the Quebec City area shows resemblance to the Cormier/Nicholas point style, and it should be older than the Early Archaic site. The spatial distribution of these sites between 11,300 and 8800 years ago indicates a rather smooth change in the exploitation of the territory, starting with a tendency to occupy the same sites and later moving to a wider range of environments.

The chapters of this volume have much in common, but one source is especially pivotal. This is "What's the Point? Modal Forms and Attributes of Paleoindian Bifaces in the New England-Maritimes Region," by James Bradley, Arthur Spiess, Richard Boisvert, and Jeff Boudreau, published in the *Archaeology of Eastern North America* in 2008. Prior to its publication, researchers in the Northeast had to rely on external references to define and discuss the essential diagnostic artifacts of the region. The purpose of the study was "to propose a set of definitions for the Paleoindian bifaces currently known within the New England–Maritimes Region . . . to provide a clearly defined set of working terms to facilitate comparisons and test hypotheses." (Bradley et al. 2008:119). These authors then set out to define the modalities of the Paleoindian bifaces metrically, stylistically, and geographically with a (partial) goal of clarifying the chronological and cultural parameters, thus offering a point of departure for future research. In a brief period of time this work has become a standard reference in Paleoindian studies. In a sense, this publication was a watershed event and represented a coming of age for the study of the Paleoindian era for the region. Its authors intended it to be used and tested as a tool, and one can judge its utility by its application in the chapters of this volume.

Another aspect touched on regularly in this volume is the importance of channel flakes (see Boisvert 2008). This particular type of artifact is mostly associated with the final stage of fluted point production. Channel flakes obtained from the final fluting process, nearly always as fragments, exhibit short truncated flake scars on their exterior that meet to form a central ridge parallel to the direction of force that removed the flake. These flakes are the product of the manufacture of the longitudinal grooves that are the diagnostic feature of Paleoindian fluted points.

The specificity of our geographic area is also worth mentioning. Recently, the impact of the Younger Dryas on North American Paleoindians has been challenged (Meltzer and Holiday 2010). If the impact seems to have been less severe in various parts of the continent, it was stressed that Paleoindians may have noticed climate changes in the Northeast (Newby et al. 2005). We can confirm that statement for the Far Northeast, which is a good example of extreme human adaptation at northern latitudes.

Other aspects make this eclectic volume thought provoking. Most chapters are concerned with settlement patterns and various recurrent themes such as high mobility expressed through an impressive lithic network including Hudson Valley chert to the west and Munsungun chert in northeastern Maine, seasonal caribou adaptation, as well as site locations and chronology. Site formation processes and the meaning of multilocus sites are other aspects discussed by several authors.

The radiocarbon-dating of North American Paleoindian

sites is one of its most challenging issues. Unfortunately, the Far Northeast is no exception, and problems such as the plateau effect (Fiedel 1999), lack of hearths with charcoal and bone, and the calibration curve with substantial differences between calendar and radiocarbon years still apply. This dating problem places the Paleoindian era in a constant debate. Although radiocarbon dating is instrumental to our discipline, its limited utility is not contributing significantly to the emerging point typology. It is with no surprise that the point typology is now the major chronological tool, a situation similar to that in the Great Lakes (Ellis and Deller 1997).

The geographic scope of this collaborative effort to bring together the existing data on the Paleoindian era at the end of the Pleistocene in the Far Northeast, though stressing the importance of environmental conditions (see Newby et al. 2005), is far from exhaustive. Still, this book should be helpful for at least a decade or more, depending on the dynamism of the field and its actors. It will thus be a basic reference for scholars interested in Paleoindian studies, the search for the First Americans, and comparisons with other areas of North America. It is our hope that in future comparative analyses the Far Northeast plays an active role and is not relegated to the background.

NOTE

1. Unfortunately, the team led by Pierre J. H. Richard, including Alayn C. Larouche, Tamylia Elkadi, and Nicole Morasse of the Université de Montréal, was not able to meet the deadline for the book. Their paper was highly complementary to the chapters by Chapdelaine and by Courchesne et al. as well as having strong implications for the Far Northeast, with the detailed environmental reconstruction of southeastern Quebec and surrounding areas. Palynologically controlled radiocarbon ages are suggesting the maintenance of a tundra for a longer time period than previously thought and giving more support to a seasonal settlement subsistence pattern based on barren-ground caribou (see Chapdelaine, this volume).

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Part I
Regional Syntheses

CHAPTER II

Paleoindian Occupations in the Hudson Valley, New York

Jonathan C. Lothrop and James W. Bradley

Much of our current perspective on late Pleistocene adaptations in New York stems directly from work by former state archaeologist William A. Ritchie and his successor, Robert E. Funk. For five decades, their investigations defined the research framework for late Pleistocene occupations of eastern New York. In so doing, their research influenced interpretations of Paleoindian lifeways in glaciated regions that extend beyond New York, including the eastern Great Lakes, New England, and the Canadian Maritimes.

In recent years, new information has come to light on the environmental setting and landscape evolution of late Pleistocene New York, providing a better basis for understanding the physical contexts for postglacial human colonization after circa 13,000 cal BP. As well, new insights (and persistent questions) on systematics and chronology cast a different light on published data for Paleoindian sites and point finds in New York (Bradley et al. 2008; Lothrop et al. 2011). Coupled with recent discoveries and analyses, this allows us to reconsider what we think we know about how the late Pleistocene peoples colonized, and then adapted to, the dynamic deglacial landscapes of eastern New York.

In this review we discuss (1) late Pleistocene landscapes, (2) scenarios for human colonization, and (3) Paleoindian settlement, subsistence, and technology for the Hudson Valley and vicinity. We also consider possible roles of the Hudson Valley and the Champlain lowlands in peopling of the Far Northeast. Our geographic focus on eastern New York includes the Mohawk-Hudson drainage basin, adjacent upland provinces, and, to a lesser extent, the Champlain Basin. To complement this study area, we also draw on data from adjoining regions. In particular, we consider the eastern New York data in relation to the broader glacial landscapes extending north and east, collectively referred to elsewhere as the New England–Maritimes (Bradley et al. 2008; Lothrop et al. 2011; Spiess et al. 1998) but referenced in this volume as the Far Northeast.

As we discuss below, most site-based evidence for Paleoindian occupation in eastern New York consists of early fluted point occupations, by default defining our primary focus. Our chronological framework relies on Bradley et al. (2008), distinguishing Early Paleoindian, Middle Paleoindian, and Late Paleoindian over the time span of circa 12,900–10,000 cal BP. Unless otherwise noted, all age and date references are based on calibrated radiocarbon dates and calendar years before present (Fiedel 1999).

LATE PLEISTOCENE LANDSCAPES IN EASTERN NEW YORK

Physiography, Geology, Drainage

Figure 2.1 illustrates physiographic regions of New York (Cadwell et al. 2003). Areas of higher elevation in eastern sectors of the state include the Appalachian Plateau, Adirondack Highlands, and Taconic Mountains, all underlain by rock units more resistant to erosion. Known regionally as the Southern Tier of New York, the Appalachian Plateau is made up of Devonian limestones, shales, sandstones, and conglomerate. The Onondaga Escarpment and its chert-bearing limestones extend west-to-east across the midsection of the state. Highly metamorphosed rocks of the Middle Proterozoic—gneisses, quartzites, and marbles—make up the Adirondack Highlands in northern New York. To the east, the Taconic Mountains are composed of metamorphosed Cambrian through Middle Ordovician rocks, including sandstones, shales, and slates.

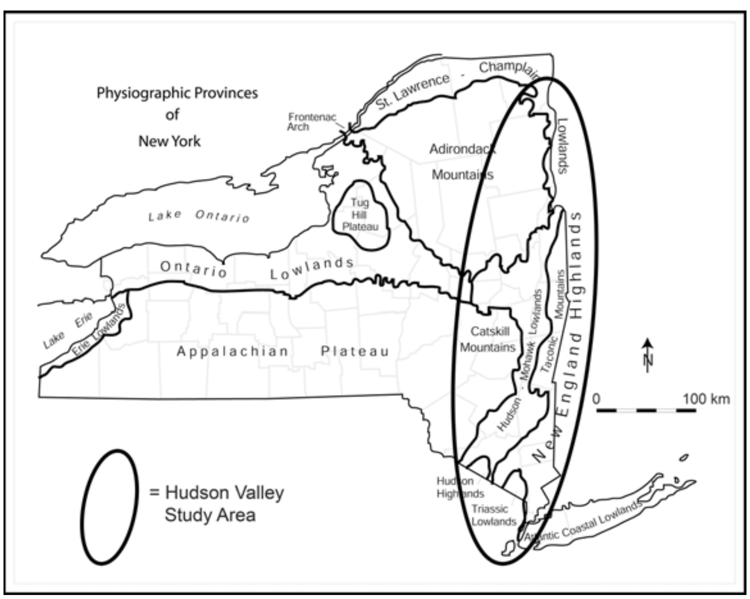
Most of the lowland provinces in New York and western Vermont are made up of limestones, shales, sandstones, and dolostones; erosion and glacial scouring created terrains of modest relief that transect the New York region. In prehistory, the Erie-Ontario, Hudson-Mohawk, and St. Lawrence-Champlain lowlands offered broad travel corridors for human and animal populations skirting the Appalachian Plateau and Adirondack Highlands. To the southeast, Long Island marks the Terminal Moraine and lies within the Atlantic Coastal Lowlands province.

The Hudson River is the master stream for eastern New York. Draining 36,000 km^2, the Hudson runs south from its source on Mount Marcy in the Adirondacks for 507 km to its mouth in New York Bay. The east-flowing Mohawk and Wallkill river tributaries provided entry for humans into the Hudson Valley from points west; the west-flowing Hoosic and Battenkill rivers led eastward (upstream) from the Hudson Valley into the rest of the Far Northeast.

Deglacial Chronology and Events

As the Pleistocene drew to a close, the face of eastern New York was dramatically reshaped by glacial retreat, sea level rise, isostatic rebound, massive drainage diversions, and the formation and draining of proglacial and inland marine water bodies (Bloom 2008; Cronin et al. 2008; Donnelly et al. 2005; Rayburn et al. 2005; Richard and Occhietti 2005; Ridge 2003; Stanford 2009; Teller 2004). Current chronologies suggest that many of these events transpired only centuries before Paleoindian colonization.

In New York, the Late Wisconsin advance of the Laurentide ice sheet reached its southern terminus circa 28,000–24,000 cal BP, creating the massive terminal moraine of Long Island. Ice margin retreat from this position began about 24,000 cal BP (Ridge 2003; Stanford 2009), a process that was periodically interrupted by glacial



2.1. Physiographic regions of New York (after Cadwell et al. 2003).

readvances, forming smaller end moraines farther north. By circa 15,500 cal BP, the glacial margin had retreated 250 km northward up the Hudson Valley to near present-day Albany. Thereafter, the pace of ice withdrawal across New York accelerated, with final retreat into Quebec by circa 13,100 cal BP (Donnelly et al. 2005; Richard and Occhietti 2005; Ridge 2003).

During this final deglaciation of eastern New York, meltwaters pooled behind the retreating ice front in the Hudson and its tributary valleys, trapped by morainal ridges on the isostatically depressed landscape. Large and small proglacial lakes formed and drained, their shoreline footprints fluctuating in response to changes in meltwater input, outlet elevations, and isostatic rebound. Although a general sequence of proglacial lakes in the Hudson Valley is known, chronological control is poor, and rough dates are often available only for either the inception or draining of some lakes. After these proglacial lakes formed, clay to silt-size sediments settled out on their bottoms, and feeder streams constructed deltas where they discharged into these water bodies. (In some cases, geologists have conferred more than one name for a particular proglacial lake with multiple stages in the Hudson valley; for simplicity, we follow Stanford's [2009:7] Lake Albany designation for proglacial water bodies that occupied the Hudson Valley bottom south of Fort Ann). After final draining of these proglacial lakes, streams dissected the lake bed sediments, and winds eroded exposed deltaic sediments, creating localized dune fields (Bloom 2008; Stanford 2009).

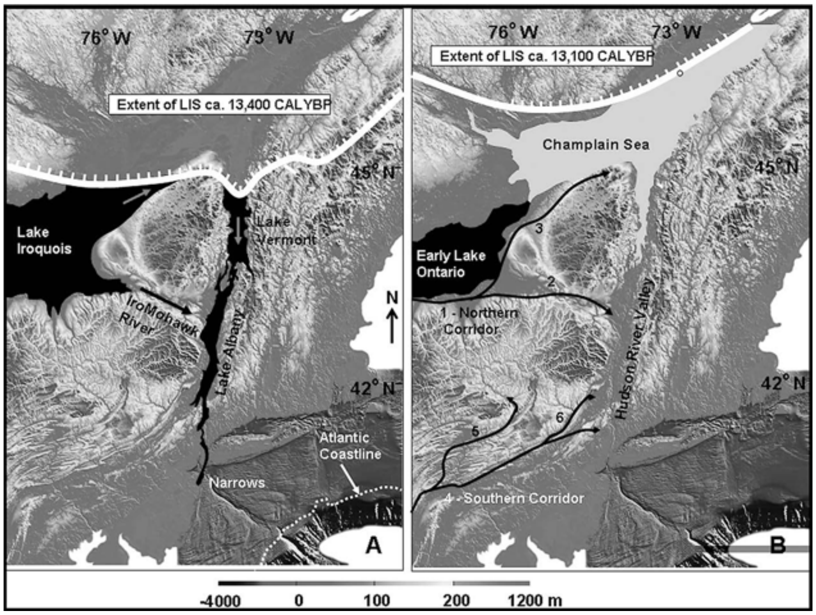
During initial ice retreat up the lower Hudson Valley between about 24,000 and 17,000 cal BP, small proglacial lakes Bayonne, Passaic, and Hackensack formed and drained in an overlapping sequence west of the Hudson Valley bottom (Stanford 2009:7–8). To the northwest, glacial retreat from the tributary Wallkill valley formed Lake Wallkill—a proglacial lake contemporary with earlier stages of Lake Albany (Stanford 2009:14).

Beginning about 22,500 cal BP, Stanford (2009:8) suggests, early Lake Albany was restricted to the lower Hudson, with a stable spillway outlet at Hell Gate, flowing eastward along the north side of Staten Island into what is now Long Island Sound. Thereafter, the location and size of Lake Albany's footprint fluctuated as it migrated upvalley, eventually reaching its northern limit near Glens Falls, east of the Adirondacks (figure 2.2B) (Cadwell and Muller 2004; Cadwell et al. 2003; Dineen et al. 1992). The total footprint of Lake Albany through time extended circa 320 km (515 miles) from the Narrows upstream to Glens Falls, with a maximum width of 50 km (80 miles) near Albany (figure 2.3). During specific stages, however, the extent of the lake's footprint was significantly smaller.

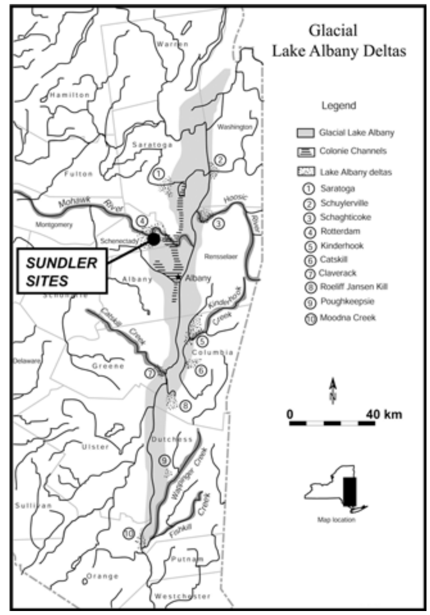
Over its lifespan, as new outlets opened, water levels in Lake Albany dropped to successive lower levels, with these later lake stages becoming more fluvial or riverlike (DeSimone 1992). Stanford (2009:14) proposes that, as the footprint of Lake Albany migrated northward up the Hudson Valley, declining water levels combined with isostatic rebound to the south exposed the former lake bed in the lower Hudson Valley. Beginning about 17,500 cal BP, the northward-shifting outlet of Lake Albany began incising the emerging lake bed downstream, creating the modern course of the lower Hudson River. Dineen (1982:3) suggests a date of 12,600 ^{14}C yr BP (ca.14,800 cal BP) for the final draining of Lake Albany, although this approximation is likely too old.

As ice withdrew up the Hudson Valley, the postglacial Atlantic shoreline of the New York region retreated at variable rates. At circa 18,300 cal BP, sea level lay 150 m lower than today, with the coastline near the outer edge of the continental shelf at the "Nicholls" shoreline position (ca. 208 km, or 130 miles, southeast of Staten Island) (Stanford 2009:Figure 2.3B). This broad exposed plain on the continental shelf was bisected by the southeast-trending course of the late glacial Hudson Valley. Between circa 18,300 cal BP and the end of the Pleistocene at circa 11,600 cal BP, regional isostatic rebound in southeastern New York nearly equaled eustatic sea level rise, resulting in only marginal landward retreat of New York's Atlantic coastline (see figure 2.2A). After 11,600 cal BP, sea level rise began to outpace isostatic rebound, resulting in more rapid transgression and drowning of the lowermost Hudson Valley (Stanford 2009:9–10, Figure 2.5).

Northwest of the Hudson Valley, ice retreat from the Ontario basin after 16,200 cal BP created proglacial Lake Iroquois along the southern margin of the ice front. With meltwater input from other Great Lakes basins to the west, Lake Iroquois continued to expand, eventually exceeding the footprint of modern Lake Ontario (see figure 2.2A).



2.2. Late Pleistocene landscapes and key deglacial events in eastern New York and vicinity, depicting dramatic changes between (A) 13,400 cal BP and (B) 13,100 cal BP. (A) Maximum footprints of proglacial lakes Iroquois and Albany; at circa 13,400 cal BP, retreat of Laurentide Ice Sheet (LIS) ice margin from the Covey Hill Gap along the northern Adirondacks reroutes drainage from the Mohawk Valley to lower-elevation outlets, draining Lake Iroquois through the St. Lawrence, Champlain, and Hudson lowlands. (B) Circa 13,100–13,000 cal BP, continued ice retreat opens the St. Lawrence Valley, and the Atlantic Ocean floods the Champlain Basin, forming the Champlain Sea. Numbered routes illustrate possible corridors for Paleoindian colonization of eastern New York. A northern corridor (1) runs east along Erie-Ontario lowlands into eastern New York (2, 3). A southern corridor (4) trends northeasterly via the Upper Susquehanna or Delaware and Wallkill valleys to the Hudson Valley (5, 6) (after Bradley 1998:15; Newby and Bradley 2007:Figure 1).



2.3. Schematic of maximum footprint of Glacial Lake Albany in eastern New York (after Cadwell et al. 2003).

Sometime between 14,600 and 13,800 cal BP, final ice retreat from the Mohawk Valley opened an outlet for proglacial Lake Iroquois near Rome, New York, routing meltwater via the ancestral IroMohawk River into later, lower stages of Lake Albany in the Hudson Valley (Ridge 2003; Stanford 2009:12; Wall 2008). Wall (2008) calculates astonishing maximum flow rates of at least 42,500 m^3 per second (1.5 million cubic feet per second) (cfs) down the IroMohawk Valley for perhaps one to three centuries before the Lake Iroquois outlet shifted to the St. Lawrence drainage circa 13,400 cal BP (see below). This estimated flow rate is 275 times greater than the average flow rate today for the modern Mohawk River (154 m^3 per second, or 5,440 cfs)(USGS 2010). At the IroMohawk–ancestral Hudson River confluence, these turbulent floodwaters stripped away glacial till and proglacial lake sediment, cutting massive potholes into bedrock (Hall 1871; Wall 2008:17–18). In 1867 construction workers discovered the Cohoes mastodon in one of these glacial potholes. AMS dating of this mastodon yielded an age of 11,070 ± 60 ^{14}C yr BP (12,930–13,050 cal BP), providing "a minimum age for pothole exposure following a drop in high water discharge during the drainage of Lake Iroquois" (Miller 2008b).

Reflecting these events, surficial geology in the Hudson Valley consists of mostly glacial till on higher elevations and proglacial lake bed sediments in valley bottoms (Cadwell and Dineen 1987). In addition, coarse deltaic sediments deposited on the margins of Lake Albany became exposed sandy plains as the lake drained (Cadwell and Muller 2004; Cadwell et al. 2003), and prevailing winds reworked these

sandy deposits into dune fields (Dineen 1975, 1982; Dineen and Hansen 1983; Donahue 1977). Today, the largest of these relic dune fields lies between Albany and Schenectady, New York, where the IroMohawk River fed higher, early stages of proglacial Lake Albany. This dune field landscape is variously known as the Albany Dunes, the Capitol Dunes Complex, or, reflecting the xeric vegetation it hosts, simply the Pine Bush.

At about 13,400 cal BP, ice retreat from the northern margin of the Adirondacks at Covey Hill opened a succession of lower outlets for proglacial Lake Iroquois, shifting outflow from the Mohawk Valley to the St. Lawrence Valley (see figure 2.2A). Waters discharging from Lake Iroquois were rerouted northeasterly around the Adirondacks, south into proglacial Lake Vermont in the Champlain Basin, and finally down the Hudson Valley to the Atlantic (Donnelly et al. 2005; Rayburn et al. 2007; Stanford 2009). Waters in the Ontario Basin dropped 90–100 m below modern levels to early Lake Ontario, a low stage with a footprint smaller than modern Lake Ontario (Anderson and Lewis 1985). Rayburn et al. (2005) and Thieler et al. (2007) propose that this drainage rerouting to the St. Lawrence, and subsequent drops in the Fort Ann outlet at the south end of Lake Vermont, released two flood pulses of meltwater (volumes estimated at 570 km^3, 130 km^3) into Lake Vermont and down the Hudson Valley. The precise timing of these events is uncertain but most likely transpired between 13,400 and 13,100 cal BP. Depending on duration as well as aggregate volumes, these outflow pulses could have caused catastrophic flooding on a gigantic scale down the Hudson Valley, further scouring the ancestral Hudson River channel.

Circa 13,100–13,000 cal BP, with final ice retreat north of the St. Lawrence Valley, the Atlantic Ocean flooded the isostatically depressed St. Lawrence and Champlain lowlands, marking the end of proglacial Lake Vermont in the Champlain Basin and creating the Champlain Sea (see figure 2.2B) (Cronin et al. 2008; Rayburn et al. 2005; Rayburn, personal communication, 2008; Richard and Occhietti 2005; Rodrigues 2006). At its maximum extent, this vast inland sea stretched 600 km (375 miles) east-west between Ontario and Quebec and 300 km (185 miles) south from Quebec into the Champlain Basin of eastern New York and western Vermont, dwarfing modern Lake Champlain. With isostatic rebound, the footprint of the Champlain Sea shrank through time and was cut off from the Atlantic Ocean at about 9800–9700 cal BP (Cronin et al. 2008). Importantly, by this current chronology the Champlain Sea overlapped the Paleoindian occupation of eastern New York and thus could have factored into regional Paleoindian subsistence and land use practices.

Late Pleistocene Paleoenvironment and Fauna

While dramatic deglacial events were fundamentally reshaping postglacial landscapes of eastern New York, regional late Pleistocene climates were also in flux, reflected by dynamic changes in vegetation as plant and tree communities recolonized the region after ice retreat and in response to subsequent climate changes. Beginning circa 14,700 cal BP, a general warming trend is indicated during the Bolling-Allerød interval. Over the next 1,400 years, both boreal and temperate forest species established themselves in the deglaciated middle and lower Hudson Valley of New York (Miller 2008a).

Between about 12,900 and 11,600 cal BP, a climatic reversal known as the Younger Dryas took place, with a sudden return to colder temperatures and decreased precipitation in the Canadian Maritimes and New England (Peteet et al. 1993). In east-central New York, mean annual temperatures were 5–10° C colder than present, similar to the modern climate of central Quebec (Miller 2008b:23).

Paleoenvironmental data for the Far Northeast indicate that plant and tree communities responded quickly (perhaps one to two centuries) to the onset of the Younger Dryas climatic reversal, but that these vegetation changes varied across the region (Maenza-Gmelch 1997; Miller 2008a, 2008b; Newby et al. 2005; Lothrop et al. 2011:550–551; Peteet et al. 1993; Shuman et al. 2002, 2004; Toney et al. 2003). In the Maritimes, tundra partly replaced spruce forests. In southern New England, boreal forest taxa (spruce, fir, and occasionally alder or birch) became more common at the expense of deciduous species like oak and ash (Newby et al. 2005; Shuman et al. 2002). In the middle-lower Hudson Valley of New York and northern New Jersey, spruce, balsam fir, and alder increased in abundance, consistent with cooler and drier conditions (Miller 2008b). Miller (2008b:23) suggests that during the Younger Dryas the middle-lower

Hudson Valley included both open and more closed forests, suggesting landscapes with mosaic-like vegetation patterns. The end of the Younger Dryas at circa 11,600 cal BP was marked by abrupt warming and even drier conditions, reflected by newfound dominance of pine and oak species.

In eastern New York, discoveries of postglacial fossils highlight a rich record of late Pleistocene terrestrial fauna, some of which persisted until Paleoindian entry into the region (e.g., Feranec and Kozlowski 2010; Funk and Steadman 1994; Hartnagel and Bishop 1922; Thompson et al. 2008). Most spectacular of these are proboscidea (American mastodon and Columbian mammoth), along with ungulates (caribou, stag-moose, and muskox) and other mammals (giant beaver, flat-headed peccary).

Robinson and Burney (2008:298) place the extinction of mastodon and mammoth in New York State at or shortly after circa 11,000 ^{14}C yr BP (12,945 cal BP). Radiocarbon dates for mastodon fossils at the Hiscock site in Genesee County, western New York, range from 11,033 ± 40 to 10,515 ± 120 ^{14}C yr BP (Laub 2003:71). At two sigma using Calib 6.1, these dates yield age ranges of 12,724–13,091 cal BP and 12,053–12,649 cal BP for the oldest and youngest mastodon dates at Hiscock. In western New York this would delimit mastodon extinction or extirpation to sometime after 12,053–12,649 cal BP, suggesting that Paleoindians and mastodons coexisted for several centuries in the New York region.

Discovery of fossil fish scales in a pollen core from Allamuchy Pond, northern New Jersey, documents the late Pleistocene presence of fish populations in the upper Delaware Valley (Daniels and Peteet 1998; Peteet et al. 1993). Scales of sucker in sediment dated 12,260 ± 220 ^{14}C yr BP (two sigma calibration of 13,730–15,094 cal BP, Calib 6.1) and of trout, sunfish, and yellow perch dated 10,740 ± 420 ^{14}C yr BP (12,406–12,929 cal BP) show that these species colonized this pond within centuries after the onset of organic deposition, presumably from late glacial refugia in the Coastal Plain and Atlantic Ocean. Similar scenarios can be envisioned for eastern New York.

Finally, together with possible marine resources along New York's since-drowned late Pleistocene Atlantic coast, the Champlain Sea supported a diverse marine fauna (see below) (Franzi et al. 2010; Harrington 1988; McAllister et al. 1988; Steadman et al. 1994).

Regional Toolstone Sources in Prehistory

Primary, bedded sources of toolstone used in prehistory by Native Americans outcrop across discrete sectors of the New York region (Funk 2004; Holland 2004). These include both Devonian and Ordovician chert-bearing formations; the most extensive outcrops consist of chert-bearing Devonian limestones along the Onondaga and Helderberg escarpments, fronting the northern and eastern margins of the Appalachian Plateau in New York (Fisher et al. 1970). Investigations of the Potts and Corditaipe sites in central and eastern New York document exploitation of these sources during the late Pleistocene (Funk and Wellman 1984; Gramly and Lothrop 1984; Lothrop 1989).

Members of the Ordovician Normanskill Group—the Mount Merino and Indian River formations—are mapped together discontinuously through the upper and middle Hudson Valley from Washington County southward into Dutchess County (Fisher et al. 1970). The Mount Merino Formation yields cherts ranging from green to black, and outcrops of the Indian River Formation may also contain green cherts (Fisher 1977; Landing 1988, 2007; Landing et al. 1992). Archaeological and geological investigations at the Greene County outcrops of West Athens Hill, Scott Farm Quarry, and Flint Mine Hill variously document mining and reduction of Normanskill chert from Paleoindian through later prehistoric times in the mid-Hudson Valley (e.g., Brumbach 1987; Burke 2006; Funk 1973, 2004; Parker 1924; Robinson et al. 2009), and fieldwork in Washington County reveals outcrops of this toolstone in the upper Hudson Valley as well (Holland and Ashton 1999). There may well be other, unrecorded outcrops in the Hudson Valley of this important toolstone source that were exploited by Paleoindians.

For the Wallkill Valley of southeastern New York and adjoining New Jersey, LaPorta (1996) and Holland (2004) describe Lower Ordovician chert-bearing formations that Native Americans mined for toolstone through much of prehistory. LaPorta (1996:73–74) notes the presence of eight different chert-bearing members in southern extensions of the Beekmantown Group in northern New Jersey. Surface finds (Lake 2003) and investigation of the Zappavigna site by Funk et al. (2003:16) indicate Paleoindian use of several Wallkill Valley chert sources, including the Epler and Ontelaunee formations.

In eastern Pennsylvania, jasper in the Hardyston Formation was mined by Native Americans throughout prehistory (Hatch 1994). Paleoindians appear to have transported this toolstone from quarries in Berks, Lehigh, and Bucks counties to sites in the Susquehanna and Delaware drainages of Pennsylvania (Carr and Adovasio 2002:21–23; Carr and McLearen 2005; Fogelman and Lantz 2006; Hatch and Maxham 1995; Lothrop et al. 2008). The likely additional presence of eastern Pennsylvania jasper in Paleoindian site collections in the upper Susquehanna and Hudson valleys of New York strongly suggests that Paleoindians imported this toolstone to the region during seasonal travels (Funk 1993:174, 2004; Ritchie 1957; Whitney 1977). This notion is consistent with sourcing analysis that links jasper at the Bull Brook Paleoindian site in Massachusetts to eastern Pennsylvania sources (Robinson et al. 2009).

COLONIZING EASTERN NEW YORK: TIMING, ROUTES, AND RESOURCES

Chronological Control

The scarcity of reliable radiocarbon dates for Paleoindian sites in northeastern North America has led archaeologists to formulate biface sequences for relative chronological control. For the eastern Great Lakes, researchers have developed a sequence of Early (fluted) and Late (nonfluted lanceolate) Paleoindian bifaces (Deller and Ellis 1988; Ellis 2004a, 2004b; Ellis and Deller 1990, 1997; Jackson 2004; Simons 1997; White 2006). For fully fluted forms, the relative ordering is Gainey-Barnes-Crowfield (table 2.1), with Simons (1997) further suggesting that Butler points are transitional between Gainey and Barnes forms. In this formulation, Gainey is viewed as oldest based on greater similarity to Clovis forms. Late Paleoindian point forms include basally thinned Holcombe and Hi-Lo forms followed by nonfluted, lanceolate points.

Building on Spiess et al. (1998), Bradley et al. (2008) proposed a similar point sequence for the Far Northeast, spanning a suggested time interval of 12,900–10,000 cal BP for this sequence. Kings Road/Whipple forms are most similar to Clovis bifaces and therefore likely oldest in this series. For fully fluted bifaces in this sequence, trends through time include decreasing basal width and maximum thickness, increasing face angle (divergence of lateral margins), and increasing flute length (similar to trends in the eastern Great Lakes). As illustrated in table 2.1, Bradley et al. (2008) proposed Early Paleoindian and Middle Paleoindian subdivisions for fluted biface forms. Reflecting a shift to nonfluted bifaces after the Younger Dryas, Late Paleoindian forms include lanceolate Agate Basin–related and Ste. Anne/Varney bifaces (Bradley et al. 2008; Newby et al. 2005).

Gramly (2008, 2009) proposes an alternate Paleoindian biface sequence for much of eastern North America, including southeastern New York. He suggests that Cumberland points in the Southeast and Great Lakes Barnes points predate Clovis, and that Folsom and Crowfield forms derive directly from Clovis. Gramly reviews the five fluted bifaces

Table 2. 1. Comparison of Modal Point Forms for New England–Maritimes and Eastern Great Lakes Regions

Chronology	*New England Maritimes*	*Eastern Great Lakes*
Early Paleoindian	Kings Road/Whipple	Gainey
~12,900–12,200 cal BP	Vail/Debert	?
(~11,000–10,300 ^{14}C BP)	Bull Brook/West Athens Hill	Butler
Middle Paleoindian	Michaud/Neponset	Barnes
~12,200–11,600 cal BP	Crowfield-related	Crowfield
(~10,300–10,100 ^{14}C BP)	Cormier/Nicholas	Holcombe
	Not represented	Hi-Lo
Late Paleoindian	Agate Basin–related	Agate Basin/Plano
~11,600–10,000 cal BP	Ste. Anne/Varney	Eden/Plano
(~10,100–9000 ^{14}C BP)		

After Bradley et al. (2008) and Lothrop et al. (2011).

recovered from Dutchess Quarry Caves 1 and 8 in Orange County, New York (Funk and Steadman 1994; Steadman et al. 1997), and classifies the complete fluted point, one basal fragment, and one tip section as Barnes points and the two remaining tip sections as Cumberland points (Gramly 2008:31). Of these five fluted points, we are uncertain about the fragmentary tip specimens but note that metric attributes for the two specimens with surviving basal segments—the complete fluted point (NYSM A2001.17.001) and the basal fragment (NYSM A74952.001)—fall within the range of variability for Michaud/Neponset forms in the Far Northeast (Bradley et al. 2008:141–146).

Why Colonize New York?

Why colonize eastern New York at the end of the Pleistocene? Most theoretical and regional models of Paleoindian colonization are ultimately resource driven. Foraging theory suggests incentives for human colonization of adjoining regions in an evolving late Pleistocene deglacial environment organized in a mosaic (as opposed to zonal) pattern (e.g., Barton et al. 2004). For example, patch choice models predict that colonizers to a new region focus on high-ranking resources such as megafauna (made more feasible by a preadapted hunting technology; Kelly and Todd 1988). Over time, population growth of foraging groups and depletion of prey species encourage groups to move into uninhabited regions nearby—an example of short-distance colonization of adjoining regions based on range shift (Spiess et al. 1998:247). Long-distance colonization may have also figured in this process, perhaps driven by other factors and relying on migration via major valley corridors, possibly moving out from ecologically rich zones (Anderson 1990; Anderson and Gillam 2000; Dincauze 1993).

For eastern New York and the Hudson Valley, a range of resources could have drawn Paleoindian explorers into the region. These included toolstone; eastern New York harbored good-quality cherts in Hudson Valley outcrops of the Ordovician Normanskill group and in Devonian formations along the east-facing Helderberg Escarpment.

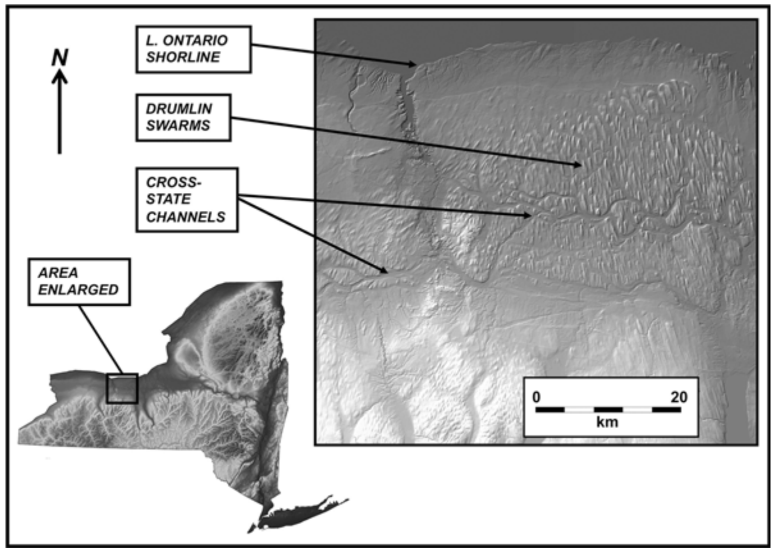
The New York region also contained a variety of late Pleistocene fauna as potential prey—including caribou and mastodon—that overlapped human occupation of the region, before extinction or extirpation (Laub and Spiess 2003; Newby and Bradley 2007). Newby et al. (2005) argue that vegetation changes in the Far Northeast at the Younger Dryas onset (more open conditions to the north and southward-shifting spruce forests) created habitats favorable to local and long-range migratory herds of caribou. Dincauze and Jacobson (2001) point to migratory waterfowl populations in the late Pleistocene as potential food resources, especially where early postglacial lake shorelines intersected Atlantic flyways.

Perhaps the largest resource draw for the New York region in the late Pleistocene, the Champlain Sea likely formed only a century or two before human colonization of New York. Loring (1980) suggested that the Champlain Sea contained marine resources attractive to Paleoindian populations, a notion receiving renewed support (Newby and Bradley 2007; F. Robinson, this volume). Discoveries of fossil remains in the former footprint of the Champlain Sea reveal a rich marine fauna inhabiting this vast inland sea that fronted northeastern New York, including five species of whales, four species of seals, more than ten fish species, and shorebirds (Franzi et al. 2010; Harrington 1988; McAllister et al. 1988; Steadman et al. 1994). Fossils of saltwater fish species suggest coastal marine habitats comparable to southern Labrador today (McAllister et al. 1988:243).

Renewed consideration of how prehistoric peoples may have colonized uninhabited landscapes, particularly in late Pleistocene North America (e.g., Haynes 2002:239–262; Meltzer 2002, 2004; Rockman and Steele 2003), highlights the critical human strategies of "wayfinding" and "landscape learning." From ethnographic data on how hunter-gatherers use landscapes, Kelly (2003:54) suggests that wayfinding through an unknown landscape was probably made easier and less risky by piloting between landmarks along easily traceable geographic features—most obviously major rivers, but also mountain ranges or other linear ecological margins. Conversely, landscapes lacking topographic relief or major waterways would have been more difficult to navigate and internalize and therefore were perhaps avoided initially.

These notions mesh well with Paleoindian colonization scenarios. Building on Bradley (1998), Newby and Bradley (2007) offer a detailed model of colonization scenarios, suggesting "northern" and "southern" corridors into eastern New York and the broader region (see figure 2.2B).

Paleoindian populations could have entered New York



2.4. Digital elevation map of west-central New York, showing west-to-east trending Cross State Channels, formed by east-flowing deglacial drainage (note drumlins truncated by these erosional channels). Abandoned before 13,000 cal BP, these relict low-relief channels could have provided pathways for movement across New York for colonizing and later Paleoindian populations (DEM imagery courtesy of Andrew Kozlowski).

from the west, perhaps from the Ohio Valley, following a northern route eastward between the Onondaga escarpment and early Lake Ontario (see figure 2.2B, 1). Traveling east along the Lake Ontario Plain, Paleoindians could have followed the Cross-State Channels (Kehew et al. 2009; Kozlowski and Pair 2007; A. Kozlowski, personal communication, 2008) (figure 2.4). These late Pleistocene erosional channels span much of the Ontario Lake Plain and were likely formed during deglaciation either by subglacial drainage or by meltwaters flowing eastward along the retreating ice front toward the Mohawk Valley. DEM imagery from central New York shows that these west-to-east trending channels run perpendicular to (and in some cases have truncated) north-south oriented Late Wisconsin drumlins on the Ontario Lake Plain. By the time of human entry into the New York region circa 13,000 cal BP, meltwater had long since abandoned these channels. With each channel measuring up to 0.5 km wide and incised 5–10 m into the late Pleistocene landscape, these features could have facilitated human colonization and later seasonal travels of Paleoindians across the Ontario Plain.

Paleoindians also could have entered eastern New York via a southern corridor, following the Susquehanna or Delaware valleys upstream (Newby and Bradley 2007; Ritchie 1957) (see figure 2.2B, 4). By crossing divides, these drainages lead into the Mohawk and Wallkill/Hudson valleys, respectively.

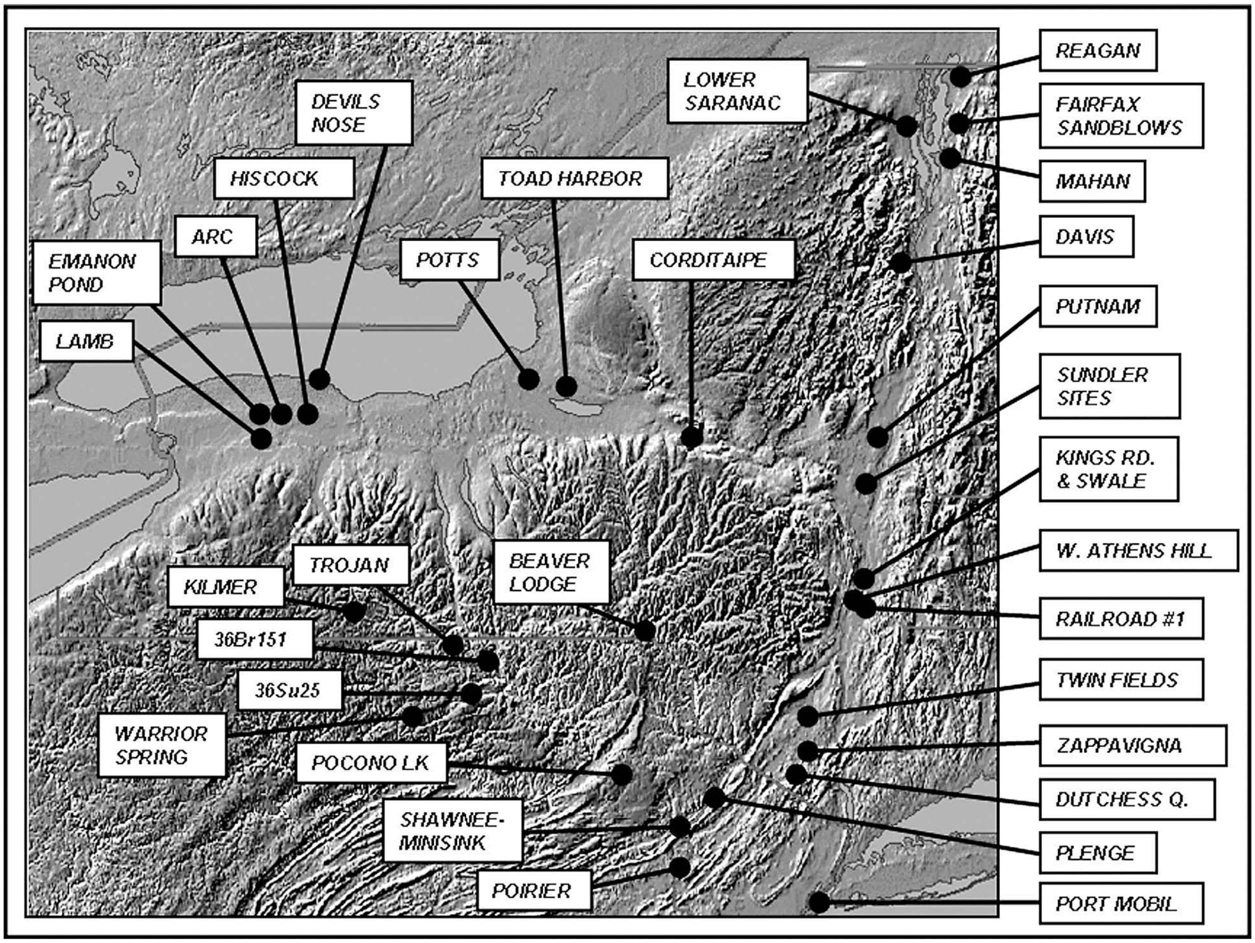
These northern and southern entry routes highlight the strategic importance of the Hudson Valley during the late Pleistocene, as a corridor for accessing toolstone and subsistence resources and also as a jumping-off point for initial entry, and later seasonal travels, into the rest of the Far Northeast.

Sequence of Colonization

Recent AMS radiocarbon dates on early Paleoindian occupations in northern Ohio and the upper Delaware Valley indicate that fluted point populations were present in regions proximal to western and southeastern New York by circa 12,900 cal BP (Gingerich 2007, 2011; Gingerich and Waters 2007; Waters et al. 2009). Consistent with the appearance of early fluted point sites and isolates across parts of the Far Northeast, we assume that this approximates the entry date for human groups into the New York region.

Paleoindian site locations in Bradley et al. (2008), calibrated with their proposed point sequence, offer a provisional window on the earliest incursions of Native American groups into the eastern New York, as well as later settlement trends. These data, combined with a subsequent review of Paleoindian site distributions across the Far Northeast (Lothrop et al. 2011), suggest changes through time in the Paleoindian occupation of eastern New York.

Early Paleoindian. Based on site distributions, eastern New York may have been most heavily occupied during Early Paleoindian times. Sites with Kings Road/Whipple points, including Port Mobil, Twin Fields, Kings Road,



2.5. Locations of selected Paleoindian sites in eastern New York and vicinity.

Swale, and West Athens Hill, record perhaps the earliest occupations in the lower-middle Hudson Valley (figure 2.5). Northeast of the Hudson Valley, Kings Road/Whipple point sites are also present in the middle and upper Connecticut valley (DEDIC, Whipple, Jefferson III) (Bradley et al. 2008:Figure 2.7). Vail/Debert point sites—believed to postdate Kings Road/Whipple point occupations—appear to be absent in eastern New York. Occupying more northerly settings, these sites appear in northwestern Maine and farther east at the Debert and Belmont site cluster in Nova Scotia (Bradley et al. 2008:Figure 11; Rosenmeier et al., this volume). Bull Brook/West Athens Hill point sites are more broadly distributed across central and southern portions of the Far Northeast and in eastern New York, include West Athens Hill, the Davis site, and perhaps the Sundler site (Bradley et al. 2008:Figure 13). Bull Brook/West Athens Hill point sites at Wapanucket, Bull Brook, and Spiller Farm record near-Atlantic coastal occupations for the first time (dated at Bull Brook to ca. 12,400 cal BP; Robinson et al. 2009), and the Windy City site at the Munsungun chert source area indicates more northerly occupations also.

After first entering a new region such as the Hudson Valley, how long would it take immigrant Paleoindians to identify optimal travel routes and critical resource areas such as toolstone outcrops and productive lands for seasonal animal and plant resources? Petersen (2004:xxvi–xxvii) suggests that in the glaciated Northeast this process was probably fairly brief: "Pioneering must have come to an end in most areas relatively quickly, perhaps only a few generations or less than 100 years." Considering the site-based evidence above for the earliest Paleoindian occupations of eastern New York, circa 12,900–12,400 cal BP, we can indeed envision "landscape learning" of the Hudson and Champlain lowlands taking place within a few generations after initial entry.

Middle Paleoindian. Later fluted point sites are much

less common in eastern New York. To date, examples are limited to the Michaud/Neponset point sites of Dutchess Quarry Caves 1 and 8 in the Wallkill Valley (Funk and Steadman 1994) and possibly the Sundler site. Funk and Walsh (1988) recorded a possible Crowfield-related point occupation at the Putnam site in the upper Hudson Valley (see figure 2.5). Farther east, Michaud/Neponset point sites occupy the eastern Champlain Basin, the middle-upper Connecticut Valley, southern Maine, and southern Quebec. In some cases, these Middle Paleoindian sites are distinguished by repeated occupation of discrete landscapes. Terminal fluted point sites with Cormier/Nicholas bifaces display a more restricted distribution focused in southern Maine, northern New Hampshire, and northwestern Vermont (Lothrop et al. 2011).

Late Paleoindian. Sites producing nonfluted, lanceolate Late Paleoindian points are also rare in eastern New York, represented only by the Lower Saranac site in Clinton County (Hartgen 1991). Ste. Anne/Varney points at this locality attest to Late Paleoindian occupation of a high terrace formed from deltaic sediments originally deposited by the ancestral Saranac River into the regressing Champlain Sea. Elsewhere in the Far Northeast, Late Paleoindian sites with Agate Basin–related and Ste. Anne/Varney points appear to concentrate in northern New England and southern Quebec (Bradley et al. 2008:Figures 23, 26). This northern focus for Late Paleoindian sites mirrors similar distributions in the eastern Great Lakes (Ellis 2004b; Ellis and Deller 1990; Jackson 2004).

Taken together, these site location data suggest that Paleoindian occupations in eastern New York were heaviest during Early Paleoindian colonization and settling in across the region. During both Middle Paleoindian and Late Paleoindian times, occupation of the region may have been less intensive, perhaps reflecting Paleoindian settlement focused farther east.

FLUTED POINTS AND SITES: IMPLICATIONS FOR PALEOINDIAN SETTLEMENT

Here we review available data from eastern New York related to Paleoindian settlement adaptations. We begin with an overview of published sites for the region and their implications for site typologies from a functional standpoint. Second, we consider a companion data set—statewide published fluted point distributions—as evidence of Early-Middle Paleoindian landscape use in eastern New York. Finally, we consider data on trends in toolstone frequencies between sites as evidence for Paleoindian mobility ranges.

Sites and Site Typologies

To date, avocational and professional archaeologists have investigated eleven sites in the Hudson Valley of eastern New York (table 2.2) and a limited number of sites in adjacent areas (see figure 2.5). Typically, these sites consist of one to five small occupation areas (as defined by artifact concentrations) and yield a range of formal and expedient stone tools and flaking debris, suggesting residential camps. Map review of these site locations offers some obvious trends in physiographic and topographic setting. All of the sites listed in table 2.2 lie in Hudson-Mohawk Lowlands; of these, three sites (West Athens Hill, Dutchess Quarry Caves 1 and 8, and Putnam) are situated on ridgetops overlooking Hudson valley bottoms. North of the Hudson Valley, the Early Paleoindian Davis site and the Late Paleoindian Lower Saranac site are the only New York sites located on the western shore of the former Champlain Sea. To the west, few sites are recorded for the Appalachian Plateau along New York's Southern Tier.

Current perceptions of Paleoindian settlement in eastern New York are conditioned by the research of Ritchie and Funk. From the 1950s into the new millennium, as sites were discovered and documented, and sometimes investigated, Ritchie and Funk incrementally built models of Paleoindian site types and settlement strategies, with interpretations of new discoveries influenced by earlier findings.

Ritchie's early studies of the Davis and Potts sites recorded small Paleoindian encampments in the Champlain Lowlands and Ontario Plain (Ritchie 1969). This was followed by Funk's important early excavations in 1966 and 1969 at the West Athens Hill site in the middle Hudson Valley (Funk 1973). Excavations at this ridgetop setting, west of the Hudson River, revealed three Paleoindian occupation areas. Funk's recovery of (1) toolstone reduction debris adjoining worked outcrops of Normanskill chert and (2) a range of unifacial tool forms led him to interpret West Athens Hill as a multipurpose site where Paleoindians

Table 2.2. Settlement Characteristics of Hudson Valley Paleoindian Sites (sorted north-south)

Site	*Physiographic Region*	*Host Landform*	*Drainage/ Drainage Basin*	*Components/ Point Forms**	*No. Occup. Areas*	*Site "Function"*	*Source*
Corditaipe	Hudson-Mohawk Lowlands	outwash terrace	Mohawk/ Hudson	EP/BB-WAH	5	residential	Funk and Wellman 1984
Putnam	Hudson-Mohawk Lowlands	terrace	Saranac/ Hudson	MP/Crowfield?	?	indeterminate	Funk and Walsh 1988
Sundler	Hudson-Mohawk Lowlands	l. Pleistocene dune field	Hudson	EP/BB-WAH?	Multiple	residential	Bradley et al. 2010; Ritchie 1957
Kings Road	Hudson-Mohawk Lowlands	l. Pleistocene lakebed	Hudson	EP/KR-W	1	residential/quarry reduction	Funk et al. 1969; Weinman and Weinman 1978
Swale	Hudson-Mohawk Lowlands	l. Pleistocene lakebed	Hudson	EP/KR-W	3?	residential/quarry reduction	Funk et al. 1969; Weinman and Weinman 1978
West Athens Hill	Hudson-Mohawk Lowlands	ridgetop/terrace strath?	Hudson	EP/KR-W and BB-WAH	3	residential/quarry reduction	Funk 1973, 1976, 2004
Railroad 1	Hudson-Mohawk Lowlands	l. Pleistocene lakebed	Hudson	EP or MP	1?	residential/quarry reduction	Funk 1976, 2004
Twin Fields	Hudson-Mohawk Lowlands	l. Pleistocene terrace	Wallkill/ Hudson	EP/KR-W	1?	residential	Eisenberg 1978
Zappavigna	Hudson-Mohawk Lowlands	Drumlin	Wallkill/ Hudson	EP/KR-W and BB-WAH?	1	residential	Funk et al. 2003
Dutchess Quarry 1 and 8	Hudson-Mohawk Lowlands	Cave	Wallkill/ Hudson	MP/M-N	2	residential?	Funk and Steadman 1994
Port Mobil	Coastal Plain Lowlands	l. Pleistocene terrace	Arthur Kill/ Hudson	EP/KR-W	2?	residential	Kraft 1977

*EP, Early Paleoindian; MP, Middle Paleoindian; LP, Late Paleoindian; KR-W, Kings Road/Whipple point component; BB-WAH, Bull Brook/West Athens Hill point component; M-N, Michaud/Neponset point component.

engaged in chert extraction and reduction during residential encampments at this important toolstone source.

Shortly thereafter, early investigations by the Orange County chapter of the New York State Archaeological Association and the New York State Museum at Dutchess Quarry Cave 1 in southeastern New York led to the "presumed association" between fluted points and late Pleistocene fauna, including caribou (Funk et al. 1970). Later, Funk returned to this locality to excavate a second reentrant containing Paleoindian material, Dutchess Quarry Cave 8 (Funk and Steadman 1994).

In the late 1960s, Tom and Paul Weinman discovered and surface-collected the Kings Road site, collaborating with Funk to document a major fluted point encampment in bottomlands near West Athens Hill, on the bed of glacial Lake Albany (Funk 1976; Funk et al. 1969; Weinman and

Weinman 1978). Later, the Weinman brothers identified another early Paleoindian occupation area adjacent to Kings Road, designated the Swale site. These two sites consist of extensive occupation areas that yielded a range of unifacial tool forms suggesting residential activities, but they also produced evidence of early- through late-stage reduction of Normanskill chert, using quarried blocks brought to the site from nearby outcrops. Recent analysis of the Kings Road and Swale collections indicates that both sites contain Early Paleoindian Kings Road/Whipple points (Bradley et al. 2007). Kings Road and Swale do differ in their relative proportion of local Normanskill chert versus imported jasper toolstone, suggesting that, although culturally related, they may not have been occupied simultaneously. Although designated as separate sites, Kings Road and Swale are perhaps best viewed as a local complex of sites that would include the nearby Scott Farm chert quarries, documenting focused occupations by Early Paleoindians in this part of the Hudson Valley. Notably, the bottomland setting of Kings Road and Swale as quarry-related reduction station and habitation areas contrasts with the hilltop location of West Athens Hill.

In 1966 avocational archaeologist John McCashion discovered another bottomland locality, located between West Athens Hill and the Hudson River, designated the Railroad 1 site (see figure 2.5). As briefly mentioned by Funk (1976:206), the Railroad site was surface-collected by McCashion on several occasions between 1966 and 1972, after which the site was disturbed by earthmoving activities. Diagnostic artifacts included a fluted point broken by a reverse hinge fracture during fluting, the latter found mostly on the eastern margin of the site. Other bifaces recovered from the site include early- through late-stage production failures whose similarities to biface rejects at West Athens Hill suggest a fluted point manufacturing sequence. Other finds included hammerstones and tabular abrading stones, blocky cores, and reduction debris (figure 2.7). Unifacial tools recovered by McCashion included endscrapers and sidescrapers with morphologies similar to those at regional fluted point sites (figure 2.8). Viewed collectively, the unifacial tool forms, the biface reduction sequence, and the toolstone reduction implements of tabular abrading stones found at the Railroad 1 site bear similarities to equivalent classes at West Athens Hill and Kings Road, leading Funk (1976:206) to conclude (and we agree) that a strong case can be made for a fluted point occupation at the Railroad 1.

As at the ridgetop setting of West Athens Hill, the three valley bottom sites—Kings Road, Swale, and Railroad 1—produced tool forms suggestive of residential encampments, along with quarried chert blocks from nearby outcrops and debris from early- through late-stage reduction of Normanskill chert. By 1973 these discoveries and findings at other eastern New York Paleoindian sites led Ritchie and Funk (1973) to formulate a Paleoindian settlement model for eastern New York, later refined by Funk (1976, 2004). In their initial formulation, they dichotomized quarry workshop sites such as West Athens Hill versus open-air encampments like Potts and Davis.

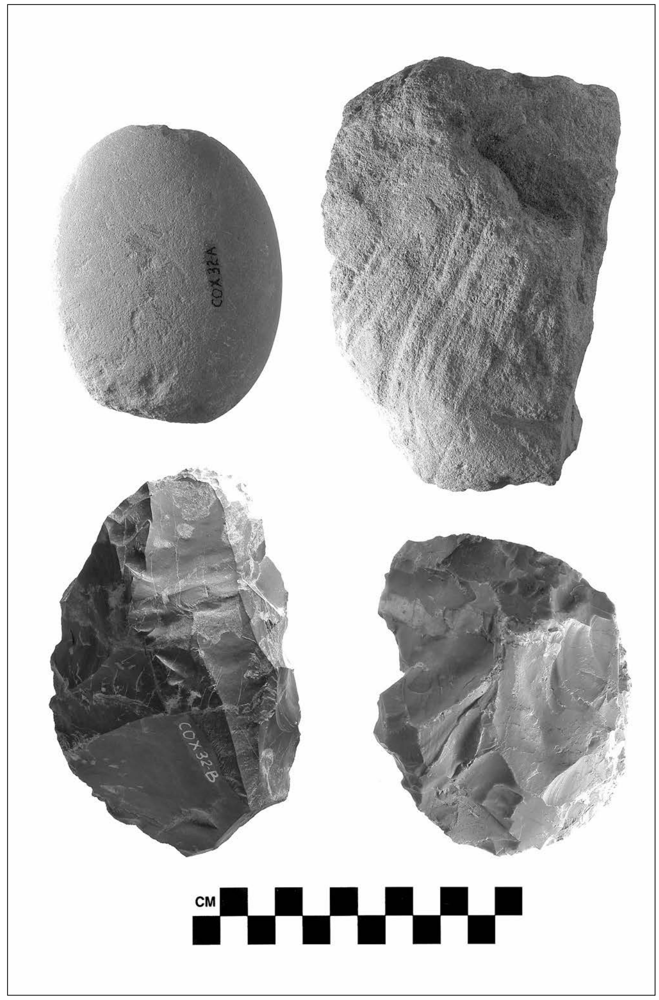
In 1973 and 1974, Leonard Eisenberg directed a field school at the Twin Fields site in Ulster County in the lower Hudson Valley (Eisenberg 1978:Appendix). The brief site report indicates that, in addition to Archaic and Woodland occupations, systematic excavations recorded an Early Paleoindian occupation in the western sector of the site. Twin Fields is a near-surface site located on a high Pleistocene terrace overlooking a tributary of the Wallkill River. Based on raw material and morphology, Eisenberg (1978) segregated 121 Paleoindian tools from the site assemblage. Recent review of this collection indicates that diagnostics include a Kings Road/Whipple fluted point base of jasper and a second fluted point tip of chert. Paleoindian unifacial tools are common and include endscrapers, sidescrapers, gravers, and utilized flakes (figures 2.9, 2.10). Toolstone is dominated by Normanskill chert, with smaller amounts of probable Pennsylvania jasper and other regional Devonian or Ordovician cherts.

With accumulating data on fluted points sites in eastern New York, Funk (1976, 1977) continued to distinguish quarry workshops at outcrops (exemplified by West Athens Hill), open-air encampments ("hunting camps"—Davis, Potts, and Kings Road (Swale had not yet been documented), and rockshelters, exemplified by the Dutchess Quarry Caves 1 and 8. He did note the seemingly hybrid nature of the Kings Road site, yielding evidence for both residential occupations and quarry-related toolstone reduction, but in a bottomland setting removed from chert outcrops.

Funk and Wellman (1984) reported on the Corditaipe

2.6. Railroad 1 site, bifaces. Left to right: two middle-stage bifaces, distal fragments; fluted point base, broken by plunging flute removal (all Normanskill chert).

2.8. Railroad 1 site, unifacial tools. Top row, left to right: sidescrapers with bits on left, right, and oblique lateral margins (all Normanskill chert). Bottom row: endscrapers (all Normanskill chert); (on specimen on right, note reworking of base to create narrow unifacial bit).

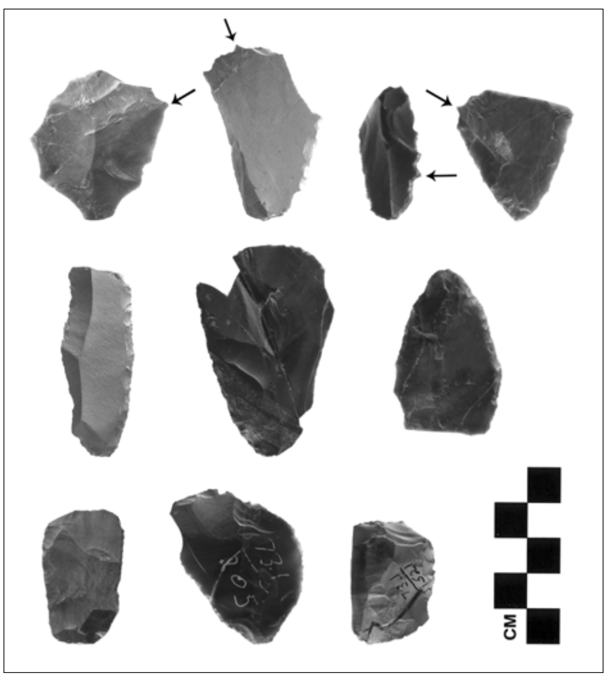


2.7. Railroad 1 site, evidence of toolstone reduction. Top row, left to right: hammerstone and tabular abrader (both sandstone). Bottom row, left to right: Exhausted polyhedral core and large biface (possible core) (both Normanskill chert).

site in Oneida County, discovered by Noel Strobino on a stream tributary terrace near the headwaters of the Mohawk. Investigations documented five Paleoindian occupation areas and both unifacial and bifacial tools made on Devonian cherts from the nearby Onondaga escarpment. Perhaps reflecting a perceived scarcity of Paleoindian sites in the vicinity, Funk and Wellman characterized Corditaipe as a small "isolated" Paleoindian campsite, "reminiscent of Davis, Port Mobil, and other relatively small sites in the Northeast" (Funk and Wellman 1984:72, 76). In his final synthesis, Funk (2004:115) further distinguished open-air residential sites associated with larger streams (Port Mobil, Twin Fields, Corditaipe) from those near smaller creeks (Zappavigna, Potts, Davis), implying to him procurement of different resources.

With hindsight, we offer brief comment on these initial Paleoindian settlement models. First, lacking radiocarbon dates and a regional Paleoindian point sequence, the Ritchie and Funk models necessarily collapsed all sites into a single time frame, potentially obscuring any temporal variation in settlement. Reflecting Funk's intensive research at West Athens Hill, these models distinguish between quarry workshop stations at outcrops and all other sites, again potentially obscuring some variation between these sites and the settlement poses they represent. Finally, several of the sites used for these modeling efforts (e.g.,

2.9. Twin Fields site, fluted points and endscrapers. Top row, left to right: fluted point base, Kings Road/Whipple form (jasper), fluted point tip (unidentified chert). Bottom row: endscrapers; note double lateral notches on specimen 1 (specimens 1–3, Normanskill chert; 4, jasper; 5, indeterminate chert).



2.10. Twin Fields site, gravers, sidescrapers, and utilized flakes. Top row, left to right: 1, graver on biface flake (Normanskill chert); 2, 3, gravers on flakes from polyhedral cores (indeterminate chert); 4, combination graver and double-bit, convergent sidescraper on biface flake (Normanskill chert). Middle row, left to right: Sidescrapers on flakes from polyhedral cores; 1, 2, single-bit examples; 3, double-bit, convergent sidescraper (1, jasper; 2, indeterminate chert; 3, Normanskill chert). Bottom row, left to right: 1, 2, utilized flakes on biface-derived flakes; 3, pièce esquillée (1, jasper; 2, 3, Normanskill chert).

Davis) were never intensively investigated, handicapping assessments of settlement behavior.

As context for future research, we note some implications of the settlement data from these investigated sites. First, with a relative chronology (Bradley et al. 2008), we can weigh possible evidence for temporal change in settlement behaviors. We note Funk's view of the West Athens Hill site (1976, 1977, 2004) as a unique upland toolstone extraction and reduction station that also served as a residential camp for entire Paleoindian social units. Perhaps because of their bottomland settings and physical separation from exploited chert outcrops, he viewed the Kings Road, Swale, and Railroad 1 sites as primarily open-air residential encampments where toolstone reduction also took place. As with West Athens Hill, however, all three of these sites witnessed early- through late-stage reduction of quarried Normanskill chert. In contrast to West Athens Hill, Paleoindian visitors at Kings Road, Swale, and Railroad 1 brought blocks of toolstone from nearby outcrops, reducing them in these valley bottom encampments.

As noted, Paleoindian occupation at Kings Road and Swale appears to be primarily associated with Kings Road/Whipple points (Bradley et al. 2007). Our preliminary reanalysis shows that West Athens Hill produced both Kings Road/Whipple and Bull Brook/West Athens Hill points, although finished examples of the latter appear to be more common. In this light, fluted point occupations at Kings Road and Swale may partially predate the most intensive occupations at West Athens Hill. The possibility that this signals changes through time in Early Paleoindian toolstone procurement and settlement in the middle Hudson Valley requires further evaluation.

Funk (1976, 1977, 2004) highlighted Dutchess Quarry Caves 1 and 8 as unique examples of Paleoindian rockshelter occupations in the Hudson Valley. In retrospect, we can consider why this is still true today. Excavations of rockshelter/cave deposits elsewhere in the Hudson Valley region by Funk (1976) and others (Funk 1989) record a redundant pattern of mostly Middle/Late Archaic and Woodland occupations, typically with Archaic materials appearing in the lowermost cultural strata. By contrast, at Dutchess Quarry Caves 1 and 8, the original entrances to the caves had partially (Cave 1) or completely collapsed (Cave 8). At Cave 8, excavators sampled deposits from what likely was the

middle or rear portions of the original cave; this could explain the absence of toolstone flaking debris in the recovered artifact sample (Funk and Steadman 1994).

Rockshelters and caves have finite life spans dictated by local geology. This begins with formation of the reentrant, a horizontal cavity that enlarges over time, ultimately leading to roof fall collapse and burial of the entrance. By way of example, in France's Périgord region (where limestone bedrock prevails) the average life span for rockshelters is circa 25,000 years (Farrand 2001). Archaeological investigations in eastern New York suggest that the cycles of cave and rockshelter development in the Hudson Valley's Devonian and Ordovician bedrock—from onset of reentrant formation to roof fall collapse—may average perhaps 10,000 calendar years or less. Thus, most caves or rockshelters that formed after deglaciation may have long since suffered roof fall collapses, with talus burying the original entrance to the cave or rockshelter. Although the Hudson Valley could harbor Paleoindian archaeological remains in other rockshelters or caves, such sites may well be obscured by talus and perhaps are detectable only with targeted remote sensing methods such as ground-penetrating radar. Indeed, investigators discovered Dutchess Quarry Cave 8 only after electrical resistivity survey revealed this residual cavity (Funk and Steadman 1994).

Recent reanalysis of the Sundler sites collection from Albany County hints at the potential for greater diversity in site locations and Paleoindian land use strategies in the Hudson Valley (Bradley et al. 2010). Avocational archaeologist Carl Sundler discovered the Sundler sites in the 1950s in the Albany Dunes complex, west of Albany. Covering 125 km^2, this late Pleistocene sand plain formed after Lake Albany drained to a lower level, perhaps during the fourteenth millennium cal BP (Cadwell and Dineen 1987; Donahue 1977) (see figure 2.3).

Ritchie (1957:86, Plates 2A, 11) briefly reported on Sundler's discoveries on these "sand flats," noting recovery of two fluted points and three unifacial tools. In 2008 reanalysis of the Sundler collection at the New York State Museum revealed a much larger assemblage of Paleoindian chert and jasper tools, from at least three recorded locations in the Albany Dunes complex (Bradley et al. 2010). Of the two fluted points, most notable is a complete but reworked specimen of spherulitic rhyolite, likely from a northern

2.11. Sundler sites, selected tools. Top row, left to right: graver and sidescraper (both jasper). Bottom row, left to right: reworked fluted point, Bull Brook/West Athens Hill or Michaud/Neponset form (spherulitic rhyolite), fluted point midsection (unidentified chert).

New Hampshire geological source (Pollock et al. 2008) (figure 2.11). This fluted point appears to be a retipped base of either an Early Paleoindian Bull Brook/West Athens Hill or Middle Paleoindian Michaud/Neponset form, suggesting Paleoindian occupation of this sand plain sometime between circa 12,700 and 11,800 cal BP.

The Sundler sites collection also includes endscrapers, sidescrapers, combination end- and sidescrapers, flake gravers, and possible pièces esquillées. These tools are mostly made of Devonian and Ordovician Normanskill cherts from the Hudson Valley but also include likely examples of Pennsylvania jasper (Bradley et al. 2010) (see figure 2.11).

Why would Paleoindians have frequented dune field settings such as Sundler? Today, remnant undisturbed portions of the Albany Dunes consist of rolling terrain, pocked with small ponds. The modern ecological communities there consist primarily of pitch pine–scrub oak barrens and pitch pine–oak forest, reflecting the sandy, well-drained character of most of this dune field landscape. Vernal ponds, found in depressions between individual dunes, are seasonally recharged by groundwater and support wetlands flora. This combination of xeric forest types and vernal pond settings in the Albany Dunes is highly unusual in New York and the broader Northeast (Barnes 2003:28–32). During the Younger Dryas, this dunefield landscape may have also harbored unique suites of plant and animal resources distinct from those found on the clayey proglacial lakebed settings that dominate the Hudson Valley bottomlands. Importantly, the Sundler sites lie in a subregion—the Mohawk-Hudson confluence—that previously held little evidence of Paleoindian occupation. Looking eastward, fluted point occupations of late Pleistocene dune fields are well known in the neighboring middle Connecticut Valley, suggesting that fluted point groups were indeed attracted to these dune field settings (Binzen 2005; Chilton et al. 2005; Curran and Dincauze 1977; Gramly 1998; Lothrop and Cremeens 2010). From this standpoint, the Sundler sites suggest that in the Hudson Valley Paleoindians likely practiced a broader suite of land use strategies that we are only just beginning to recognize.

Fluted Points and Favored Landscapes

Across the Far Northeast, archaeologists have recently observed that many Paleoindian sites appear to cluster in distinctive settings, perhaps suggesting key resource areas for Paleoindian populations (Bradley et al. 2008:119; Lothrop et al. 2011). In the mid-Hudson Valley, the West Athens Hill, Kings Road, Swale, and Railroad 1 sites represent one such cluster. As noted above, in Massachusetts and Connecticut recorded Paleoindian sites cluster on late Pleistocene dune fields in the middle Connecticut Valley. Spiess et al. (this volume) report fluted point site clusters in Maine's upper Magalloway Valley and on the Kennebec Sand Plain. Boisvert (this volume) documents fluted point site concentrations on deglacial terrain fronting the White Mountains of northern New Hampshire, with regional rhyolite sources in the vicinity. Rosenmeier et al. (this volume) and Bernard et al. (2011) describe the Debert-Belmont site cluster in Nova Scotia; during the Younger Dryas, these sites were situated on a periglacial landscape near small, reactivated glaciers. In the Yukon, recent discoveries of stratified caribou dung and still-hafted prehistoric weaponry, found melting out of ice patches (Farnell et al. 2004; Hare et al. 2004), document a long-term association between caribou prey and prehistoric hunters at these northern ice patch settings. These finds offer a seasonal caribou predation model for Paleoindian occupation of the Debert-Belmont complex and also remind us that some attributes that made certain landscapes attractive in prehistory may not be immediately evident today.

To gauge patterns of colonization and Paleoindian land use strategies at regional and continental scales, archaeologists are increasingly also turning to databases of fluted and late Paleoindian point distributions, typically assembled at the state level (Anderson et al. 2010). In New York, this effort began with Ritchie's 1957 report, *Traces of Early Man in the Northeast*. For the next thirty-five years, the New York State Museum actively maintained a data file on fluted point distributions for New York, reported most recently by Beth Wellman (1982). Accessible today at the Paleoindian Database of the Americas (PIDBA) (http://pidba.utk.edu/main.htm), these data consist of fluted point frequencies per New York county (along with county land area in square miles) as of 1982. Although clearly in need of updating, these data offer another view on Paleoindian land use in New York.

Wellman (1982) reported counts of one or more fluted points in forty-seven of New York's sixty-two counties. At the county level, these frequencies range from a high of forty-seven recorded for Greene County down to single specimens each for twelve New York counties. Those fifteen counties lacking recorded fluted points appear across all subregions of New York, but there is a notable absence of fluted points on the east side of the middle Hudson in the four contiguous counties of Rensselaer, Columbia, Dutchess, and Putnam and on the east side of the lower Hudson in the contiguous counties of Bronx, New York, and Kings. These distributional gaps led Ritchie (1957) early on to suggest that the east side of the Hudson Valley was largely uninhabited by Paleoindians (see below).

Based on a total land area for New York of 47,126 square miles (122,056 km^2), the 290 fluted points yield a statewide density of 0.006 fluted points per square mile (0.0024 points per km^2).

We converted the raw fluted point counts by county to density values by dividing each county's fluted point frequency by its area in square miles. This yields densities ranging from a high of 0.073 fluted points per square mile for Greene County down to 0.001 fluted points square mile for Sullivan County in southeastern New York. Table 2.3 lists the ten counties with highest point densities, based on these raw counts and sorted by rank order.

There are, to be sure, undeniable biases in these data. For example, at some excavated sites (e.g., West Athens Hill; Funk 2004), investigators included unfinished fluted preforms in their point counts—strictly speaking, manufacturing rejects, not finished fluted points. Also, as Wellman (1982:39) notes, these site investigations themselves in effect inflated fluted point counts for a handful of counties. Thus, of the 47 points reported for Greene County, 38 derive from the West Athens Hill site and three from Kings Road. To minimize the effect of such biases, we standardized these data so that counties with investigated sites would not unduly influence geographic patterning. We did so by subtracting fluted point counts for individual sites from the respective county total and then assigning (and adding back in) a count of one fluted point for each investigated site. By this method, Greene County (with 41 points reported from two investigated sites) yielded a standardized point count of 8 (47 – 41 = 6 + 1 + 1 = 8).

With Wellman's data standardized in this manner, fluted point frequencies per county range up to a more modest high of 17 each for Orange and Onondaga counties. Converting these raw counts to density values as before yields densities ranging up to a high of 0.068 fluted points per square mile for Richmond County (Staten Island, New York). This step also yielded a much lower ranking for Greene County.

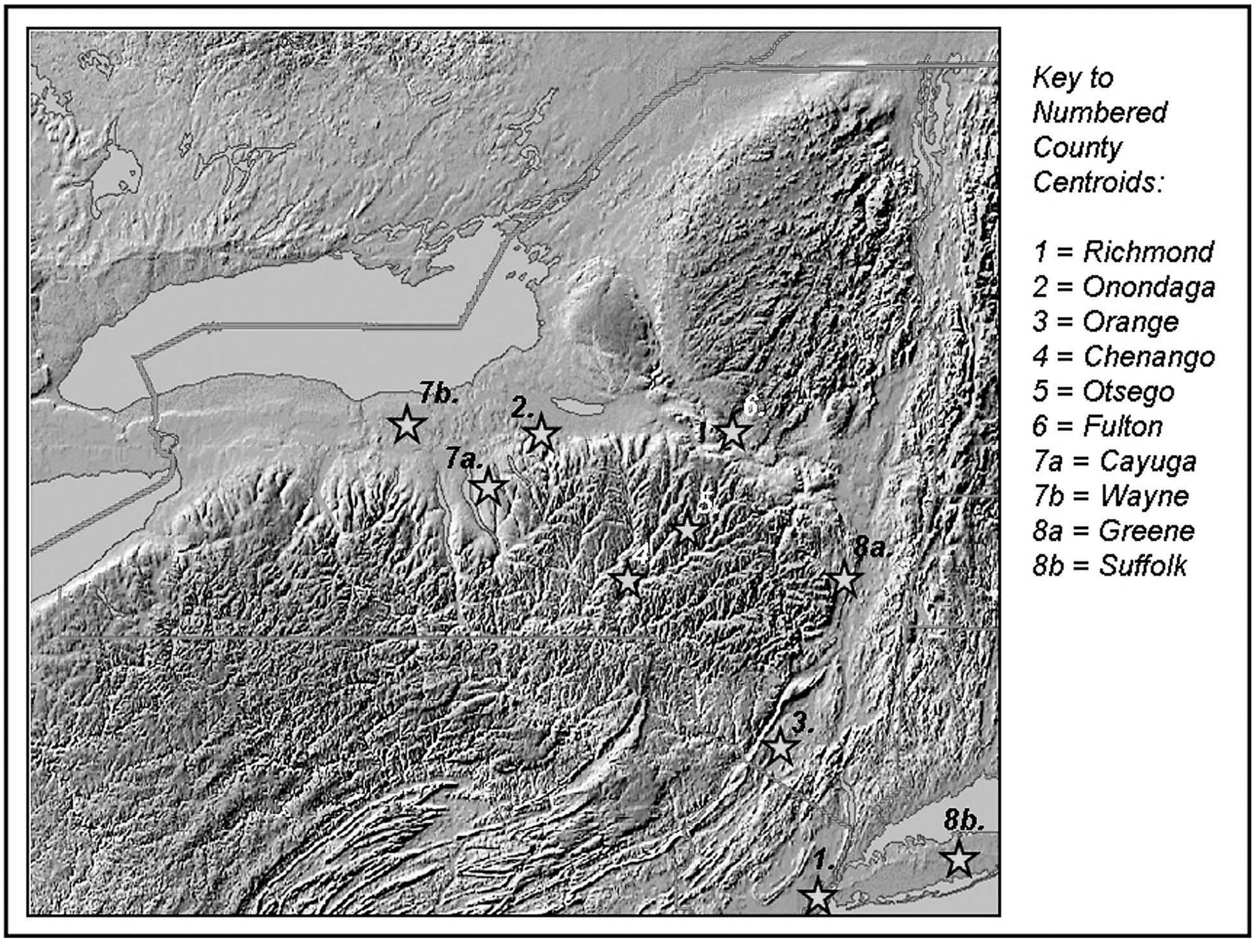
Figure 2.12 shows the distribution of counties with the ten highest standardized densities, with stars marking their geographic centroids. Although using 1982-vintage data, these locations of peak fluted point density in eastern New York provide a useful counterpoint to recorded Paleoindian site locations. As with site distributions, seven of the ten counties with high fluted point densities intersect physiographic lowlands (Erie-Ontario, Hudson-Mohawk, Atlantic Coastal). But unlike the site distributions, two counties with high fluted point densities—Chenango and Otsego—occupy the Appalachian Plateau, and Fulton County straddles the Adirondack Highlands and Hudson-Mohawk Lowlands subprovinces.

Taken together, Wellman's 1982 data attest to Paleoindian use of certain highland settings as well as lake plain and valley lowlands. Notably, there is no strong signal for

Table 2.3. Rank Order of Ten New York Counties with Highest Fluted Point Densities

County	*Physiographic Region**	*County Area (mi.^{2})*	*Fluted Point Count (raw counts)*	*Fluted Points/mi.^{2} (raw counts)*	*Density Rank Order (Raw counts)*	*Fluted Point Count (standardized)*	*Fluted Points/mi.^{2} (standardized)*	*Density Rank Order (standardized)***
Greene	HML and AP	648	47	0.073	1	8	0.012	8a
Richmond	ACL	59	20	0.034	2	4	0.068	1
Orange	HML	826	19	0.023	3	17	0.021	3
Onondaga	EOL and AP	784	17	0.022	4	17	0.022	2
Chenango	AP	897	16	0.018	5	16	0.018	4
Otsego	AP	1004	17	0.016	6a	17	0.017	5
Fulton	AH and HML	497	8	0.016	6b	8	0.016	6
Cayuga	EOL and AP	695	9	0.013	7a	9	0.013	7a
Wayne	EOL	605	8	0.013	7b	8	0.013	7b
Suffolk	ACL	911	11	0.012	8	11	0.012	8b

Data from Wellman (1982).
*ACL, Atlantic Coastal Lowlands; EOL, Erie Ontario Lowlands; HML, Hudson-Mohawk Lowlands; AP, Appalachian Plateau; AH, Adirondack Highlands.
**See figure 2.12.



2.12. County centroids and rank order for ten New York counties with highest fluted point densities, using standardized Wellman (1982) data.

Paleoindian use of the northern Adirondacks or the western shore of the former Champlain Sea (e.g., Essex County in the eastern Adirondacks yields a density value of only 0.004 fluted points per square mile). This is somewhat counter to our expectations, given F. Robinson's (this volume) substantial evidence for Early through Late Paleoindian land use along the eastern shore of the Champlain Sea in Vermont. This discrepancy could simply reflect underrepresentation of fluted point counts for the Champlain Lowlands of New York in Wellman's 1982 data.

What do the Wellman (1982) data tell us about New York landscapes that were favored by Paleoindians? In the mid-Hudson Valley proper, the density peak in Greene County reinforces the notion that Paleoindians regularly exploited that area's outcrops of Ordovician Normanskill and Devonian cherts (see figure 2.12). For southeastern New York we might speculate that late Pleistocene plant or animal resources of the "Black Dirt" region in Orange County's Wallkill Valley attracted colonizing and later fluted point groups. Because of its position fronting the Narrows of the late Pleistocene Lower Hudson, Richmond County (modern Staten Island) may have also harbored unique resource suites in the late Pleistocene. In central New York, peak densities in Onondaga, Cayuga, and Wayne counties may relate to terrestrial resources of the Erie-Ontario Plain. On the Appalachian Plateau, high fluted point densities in Chenango and Otsego counties may partly reflect use of the upper Susquehanna Valley as a travel corridor between eastern Pennsylvania and eastern New York.

That said, these fluted point distributional data and the implied trends for Paleoindian land use must be taken with several grains of salt. Wellman herself (1982:39) mentions other sources of bias, noting, for example, that high fluted point densities for Chenango and Otsego counties

were likely inflated by Whitney's (1977) systematic recording of Paleoindians artifacts in the Upper Susquehanna/Chenango drainage. Further, the higher densities of fluted points reported by Wellman (1982) for central and eastern New York counties surely reflect Ritchie and Funk's long-term research focus in these areas (and their reporting network of mostly avocational archaeologists). More recent studies of Paleoindian sites in western New York now reveal substantial late Pleistocene occupation in this part of the state (e.g., Gramly 1988, 1998; Laub 2003; Tankersley 1994, 1995; Tankersley et al. 1997) (see figure 2.5). Wellman's 1982 data on fluted point distributions are useful for suggesting some provisional trends, but reports of recent discoveries in eastern New York (e.g., Ashton 1994; Bradley et al. 2010; Funk and Walsh 1988; Funk et al. 2003; Jamison 1996; Lake 2003; Levine 1989; Rush et al. 2003; Schackne 2005) emphasize the need to update this information.

Schackne's 2005 study of Paleoindian site and point distributions in the mid-Hudson/Wallkill valleys exemplifies new insights from recent point discoveries. Importantly, her study area includes counties on the east side of the Hudson River—previously terra incognita for Paleoindian occupation. Prior to this study, no sites or isolated finds had been documented on the east bank of the middle Hudson, leading Ritchie (1957:11) and Dincauze and Jacobson (2001:122) to view this reach of the Hudson River not as a corridor but as a barrier that prevented Paleoindians from inhabiting the east side of the valley. Schackne (2005) reports new discoveries by Ted Filli and others of fluted and late Paleoindian bifaces at five locales in Columbia County. These data suggest significant Paleoindian occupation on the east side of the Hudson valley, a finding predicted by Funk (2004:115).

For her larger mid-Hudson/Wallkill valley data set, Schackne (2005) sees a potential association between Paleoindian occupations and lakebed deposits or relic shorelines of the terminal (Fort Ann) low stage of Lake Albany. She notes that Paleoindians were perhaps keying on ecotonal settings at these lakebed deposits. Her findings reinforce the need to synthesize new locational data on Paleoindian sites and isolated finds and to consider environmental factors beyond chert outcrops to better understand late Pleistocene settlement in the New York region.

With this in mind, we have restarted the New York State Museum fluted point survey as the New York Paleoindian Database Project (NYPID) (Lothrop 2009). Our first goal is comprehensive recording of locations and attributes of Paleoindian bifaces across New York. Like PIDBA, a web page will help to solicit information, provide access to data for researchers, and disseminate new findings (www.nysm.nysed.gov/nypid/index.html). The collective efforts of avocational and professional archaeologists will help to refine our understanding of variation in Paleoindian bifaces and land use strategies through time across New York.

Toolstone and Paleoindian Mobility

For more than fifty years, northeastern archaeologists have debated the implications of toolstone variation in Paleoindian assemblages. With only rare exceptions (Moeller 1980), for nearly all analyzed sites in the glacial Northeast cortical surfaces on stone tools and flaking debris point to acquisition from primary outcrop sources (Ellis 1989, 2008; Lothrop 1989; Petersen 2004; Spiess 2002; Spiess et al. 1998:239). This contrasts with locations farther south, such as the Mid-Atlantic Coastal Plain, where Paleoindian groups had to rely on secondary cobble materials as the only available toolstone (Custer et al. 1983).

In turn, most researchers see the raw material profiles from these Paleoindian sites as evidence for direct procurement of the most common toolstone varieties (as opposed to acquisition by exchange or other indirect means) (Ellis 2008, 2011). Along these lines, Meltzer (1989) finds no persuasive evidence for systematic exchange of large quantities of cherts among eastern Paleoindian groups, consistent with the notion that these peoples acquired most toolstone by direct procurement.

Where toolstone profiles at northeastern Paleoindian sites consist of more than one raw material type, we suggest that the majority and first-tier minority lithic types most likely represent direct procurement. Second-, third-, or fourth-tier minority raw materials could variously reflect (1) direct procurement, (2) indirect "acquisition" due to shifts in band membership via mating networks, (3) deliberate exchange, or (4) some combination of these (Ellis 2011; Lothrop 1989; Petersen 2004).

In the glaciated Northeast, early and middle Paleoindian sites are often located at distances of 200–300 miles from presumed geological sources of artifact toolstone, leading

to the prevailing interpretation of extensive annual mobility that we favor (e.g., Bradley and Boudreau 2006; Burke 2006; Ellis 1989, 2008, 2011; Goodyear 1989; Gramly 1988; Lothrop 1989; Petersen 2004). Typically, absence or scarcity of cobble cortex on tool surfaces also indicates that, where raw materials are found south of their geological sources, this cannot be explained by glacial transport. Gardner (1989, 2002) draws a distinction between Paleoindian mobility in the glacial Northeast and in the unglaciated Southeast, south of Pennsylvania. Biomes in these southern late Pleistocene landscapes were fundamentally different and supported settlement strategies with more limited residential mobility.

Some researchers suggest that Paleoindians of the Far Northeast procured toolstone by logistically organized task groups, meaning that raw material profiles for individual sites may overestimate annual ranges of residential groups (Spiess 2002; Spiess and Wilson 1989). The wide range of tool classes documented at quarry reduction–related sites like West Athens Hill, Kings Road, and Swale, indicating occupations by entire residential units, suggests to us that, at least for early Paleoindians in eastern New York, toolstone procurement was likely embedded in larger seasonal patterns of residential mobility. Ellis (2011) argues that this pattern of embedded rather than logistical procurement of toolstone applied to early Paleoindians in both the eastern Great Lakes and Far Northeast.

Witthoft (1952) and Ritchie (1957) were the first researchers to ponder how to interpret imported toolstone on New York Paleoindian sites. Ritchie (1957:11) suggested that the presence of probable eastern Pennsylvania jasper as a minority raw material at some Hudson Valley sites signified a progressive northward shift through time of annual ranges. In this scenario, Paleoindian groups inhabiting eastern Pennsylvania first explored the Hudson Valley on an intermittent or seasonal basis and later transitioned to annual ranges more focused on eastern New York. Although Funk (1976:224–225, 2004) remained unconvinced, we see this scenario as still persuasive.

Gramly (1988:267–270, Figure 1) compared likely source locations of Ordovician and Devonian toolstone to Early Paleoindian site proveniences in New York and northern Pennsylvania and hypothesized "band territories" for early Paleoindians extending (1) from eastern Ohio to western New York; (2) from central New York to central Pennsylvania; and (3) from the eastern Ontario Plain to the lower Hudson Valley. This last region is based on the distribution of Normanskill chert on Paleoindian sites extending along the length of the Hudson Valley and up the Mohawk to the Ontario Plain. Bradley and Boudreau (2006) note the presence of probable Normanskill chert in fluted point assemblages in eastern Massachusetts and suggest annual ranges for Early-Middle Paleoindian groups extending from the Hudson Valley east to the near-Atlantic coast.

Table 2.4 qualitatively summarizes provisional Early and Middle Paleoindian evidence for (1) major chert sources exploited within New York, (2) extraregional cherts imported to New York, and (3) New York cherts exported to other regions. For cases where fluted point groups likely imported toolstone into the New York region, much of the

Table 2.4. Transport of Paleoindian Toolstone into and from the New York Region

*Region (Province)**	*Imported Toolstone (probable source/region)*	*Regional Toolstone*	*Exported Toolstone and Destination Region*	*Primary Source*
Western New York (EOL)	Upper Mercer, Vanport (eastern OH)	Devonian	Devonian ("W. Onondaga") to Susquehanna Valley	Gramly 1988
Central New York (EOL and AP)	Jasper (eastern PA)	Devonian	Devonian (Onondaga) to Susquehanna Valley	Funk 2004, 1993:173–179; Whitney 1977; Gramly 1988
Eastern New York (HML)	Jasper (eastern PA)	Normanskill, Devonian	Normanskill (Far Northeast and mid-Atlantic; see table 2.5)	Bradley and Boudreau 2006; Funk 2004; Gramly 1988, 1998; Spiess et al. 1998

*EOL, Erie Ontario Lowlands; AP, Appalachian Plateau; HML, Hudson-Mohawk Lowlands

movement seems to be on a southwest-to-northeast axis. This includes Ohio cherts imported eastward via the Ohio Valley and jaspers carried from eastern Pennsylvania into the upper Susquehanna and Hudson valleys.

Table 2.5 lists the reported presence of Normanskill chert artifacts at fluted point sites across the Far Northeast and mid-Atlantic regions. These data suggest that Normanskill chert was transported up to 400 km from its Hudson Valley source outcrops: north and east to sites in the Connecticut and Androscoggin valleys and near-coastal Atlantic areas; north and south along the Hudson-Champlain corridor; and west and south along the Susquehanna and Delaware drainages. These reported identifications of Normanskill chert largely rely on macroscopic criteria, but recent sourcing analyses by Burke and colleagues confirm transport of this chert circa 250 km east from the Hudson Valley to the Bull Brook site, where it is the most common lithic raw material (Robinson et al. 2009:426–427). Likewise, petrographic analysis indicates transport of Normanskill chert 325 km west to the Kilmer site in Steuben County, western New York (Tankersley et al. 1996). Though more comprehensive geological sourcing is needed to confirm this apparent pattern, these provisional data suggest that Paleoindians transported Normanskill chert artifacts from the Hudson Valley to many destinations on the late Pleistocene landscape, both within and beyond the Far Northeast. This interpretation highlights the strategic role of the Hudson Valley in the late Pleistocene, not only as an interregional toolstone source but also as a portal for Paleoindian residential movements into the Far Northeast.

For a handful of eastern New York sites, we can compare relative dating and raw material profiles to detect possible changes in toolstone use and mobility over time. Especially useful in this regard are Funk's (2004:Tables 42, 43) frequency data on imported toolstone for Hudson Valley sites (based on visual classification). We isolated a single minority raw material—Pennsylvania jasper—and calculated its percentage of all toolstone for five sites (table 2.6). Those sites with Kings Road/Whipple point forms (Twin Fields, Kings Road, Swale) show higher percentages of jasper, ranging from 8.07 to 44.13 percent. By contrast, presumably later sites with mostly Bull Brook/West Athens Hill bifaces (West Athens Hill areas A and B, Corditaipe) yielded far fewer tools of jasper, ranging from 0.68 to 3.11 percent.

This proportional decline in Pennsylvania jasper, from presumed older site occupations (represented by Kings Road/Whipple points) to later encampments (Bull Brook/West Athens Hill bifaces), could signal reduced access through time to sources of this eastern Pennsylvania toolstone. As Ritchie (1957:11) suggested, this could reflect earlier colonizing visits from eastern Pennsylvania into the Hudson Valley, followed later by northward range shift for Paleoindian groups into eastern New York and beyond, with less frequent return forays to eastern Pennsylvania.

PALEOINDIAN TECHNOLOGIES

Archaeologists have traditionally focused on the nonperishable component of Paleoindian technology—flaked stone tools and debris—but rare discoveries reveal some organic elements of late Pleistocene material culture. Discoveries at the Sheriden Cave site in northwestern Ohio (Tankersley 2004:54–59) and at Clovis sites in Florida and the Southwest provide a window into a potentially wide range of bone and ivory artifacts (Bradley et al. 2010:114–132).

With two possible exceptions, such discoveries are virtually unknown for Paleoindian sites in the glaciated Northeast. Kellogg (2003:114–115) reports the recovery of a possible worked antler fragment from the Neal Garrison site in York County, Maine. This specimen displays a possible barb remnant and could represent an atlatl hook, similar to another candidate observed by Spiess in the Bull Brook collection. In western New York, excavations at the Hiscock site have recovered possible tools of mastodon bone and ivory (Laub et al. 1996; Tomenchuk 2003), although Haynes (2002:127–128) expresses concern about the cultural status of some specimens. The Hiscock site has also yielded possible evidence of textile or basketry that may associate with late Pleistocene human activities at the site (Adovasio et al. 2003).

Our current knowledge of Early-Middle Paleoindian stone technology in New York stems from artifact samples recovered at a few quarry reduction–related sites (on or near toolstone outcrops) and from other residential sites removed from toolstone sources. Regardless of distance from source, eastern New York fluted point sites have yielded biface and uniface classes of formal and expedient tools (Funk 2004; Funk and Wellman 1984; Funk et al.

Table 2.5. Investigated Paleoindian Sites with Reported Artifacts of Normanskill Group Cherts

Site	*County/State*	*Distance from Hudson Valley Outcrops to Site (km)*	*Direction of Movement from Hudson Valley*	*Normanskill Chert: Proportion of Sample**	*Components/Point Forms***	*Source*
			Atlantic Drainage Basin			
Dam	Kennebec County, ME	375	northeast	minor	EP/BB-WAH	Spiess et al. 1998
Michaud	Androscoggin County, ME	350	northeast	minor	MP/M-N	Spiess et al. 1998
Hedden	York County, ME	350	northeast	minor	EP or MP	Spiess et al. 1998
Bull Brook	Essex County, MA	250	east	major	EP/BB-WAH	Robinson et al. 2009
Wapanucket 8	Plymouth County, MA	225	east	minor	EP/BB-WAH MP/M-N	Bradley and Boudreau 2008
Neponset	Norfolk County, MA	225	east	minor	MP/M-N	Spiess et al. 1998
Hidden Creek	New London County, CT	150	southeast	minor	MP/C-N	Spiess et al. 1998
			Merrimack Drainage Basin			
Shattuck Farm	Essex County, MA	225	east	minor	MP/Crowfield-related	Spiess et al. 1998
			Androscoggin Drainage Basin			
Vail	Oxford County, ME	400	northeast	major	EP/Vail-Debert	Spiess et al. 1998; Gramly, pers. comm., 2010
			Connecticut Drainage Basin			
Jackson-Gore	Windsor County, VT	200	northeast	minor	MP/M-N	Crock and Robinson 2009
DEDIC	Franklin County, MA	100	east	minor	EP/KR-W	Gramly 1998
			Thames River Drainage Basin			
Liebman	Windham County, CT	100	southeast	major	MP/M-N?	Spiess et al. 1998
			Champlain Basin			
Reagen	Grand Isle, VT	300	north	minor	MP/Crowfield, C-N LP/Ste. Anne/Varney	Robinson 2009
Fairfax Sandblows	Grand Isle, VT	275	north	minor	MP/M-N	Robinson and Crock 2008
Mahan	Chittenden, VT	250	north	minor	EP/BB-WAH	Jess Robinson, pers. comm., 2010
Davis	Essex County, NY	225	north	minor	EP/BB-WAH	Funk 2004; Bradley et al. 2008
			Mohawk-Hudson Drainage Basin			
Corditaipe	Oneida County, NY	225	northwest	minor	EP/BB-WAH?	Funk and Wellman 1984

Table 2.5. *continued from previous page*

Site	*County/State*	*Distance from Hudson Valley Outcrops to Site (km)*	*Direction of Movement from Hudson Valley*	*Normanskill Chert: Proportion of Sample**	*Components/Point Forms***	*Source*
Sundler	Albany County, NY	50	north	minor	EP/BB-WAH?	Bradley et al. 2010
Kings Road/Swale	Greene County, NY	<1	na	major	EP/KR-W	Funk 2004
West Athens Hill	Greene County, NY	0	na	major	EP/KR-W and BB-WAH	Funk 2004
Railroad	Greene County, NY	<1	na	major	EP or MP?	Funk 1976
Twin Fields	Ulster County, NY	100	south	major	EP/KR-W	Funk 2004
Port Mobil	Richmond County, NY	200	south	minor	EP/KR-W	Funk 2004
			Ontario Drainage Basin			
Potts	Oswego County, NY	250	northwest	minor	EP/Gainey MP/Barnes	Lothrop 1989
Toad Harbor	Oswego County, NY	250	northwest	minor	EP/Gainey or Butler?	Bradley, unpublished files
			Delaware Drainage Basin			
Beaver Lodge	Delaware County, NY	150	southwest	major	EP or MP/Fluted	Rudler 2006
Pocono Lake	Monroe County, PA	200	southwest	minor	MP/Barnes?	Carr and Adovasio 2002; Fogelman and Lantz 2006
Plenge	Warren County, NJ	200	southwest	minor	EP/"Clovis"?	Kraft 1973
Poirier	Northhampton County, PA	225	southwest	minor	EP/"Clovis"	Fogelman and Poirier 1990; Carr and Adovasio 2002
			Susquehanna Drainage Basin			
Kilmer	Steuben County, NY	325	west	minor	EP/Gainey LP/Holcombe, Hi-Lo	Tankersley et al. 1996
36Su25	Bradford County, PA	275	southwest	minor	EP or MP/Fluted	Lothrop et al. 2008
Warrior Spring	Lycoming County, PA	300	southwest	minor	EP/"Clovis"	Fogleman 1988; Carr and Adovasio 2002
Saginaw	York County, PA	400	southwest	minor	EP/"Clovis" and Cumberland	Gramly 2009; Fogelman and Lantz 2006
Higgins	Anne Arundel County, MD	450	southwest	minor	EP or MP/Fluted	Ebright 1989, 1992

*major, most common raw material; minor, minority raw material.
**EP, Early Paleoindian; MP, Middle Paleoindian; LP, Late Paleoindian; KR-W, Kings Road/Whipple point component; BB-WAH, Bull Brook/West Athens Hill point component; M-N, Michaud/Neponset point component; C-N, Cormier/Nicholas point component.

Table 2.6. Frequency of Jasper Tools Found at Selected Fluted Point Sites in the Hudson-Mohawk Lowlands

Site	*Primary Component**	*Total Tool Count*	*Jasper Tool Count*	*% Jasper of Total Tool Count*	*Rank Order*
Swale	KR-W	247	109	44.13	1
Twin Fields	KR-W	121	15	12.39	2
Kings Road	KR-W	384	31	8.07	3
Corditaipe	BB-WAH	161	5	3.11	4
West Athens Hill, areas A and B	BB-WAH	1308	9	0.68	5
West Athens Hill, area C	BB-WAH	1153	1	0.08	6

From Funk (2004:Tables 42, 43).
*KR-W, Kings Road/Whipple point component; BB-WAH, Bull Brook/West Athens Hill point component.

2003; Gramly and Lothrop 1984; Lothrop 1988). At a general level, these morphological artifact types are similar to those found at sites across the Far Northeast (Spiess et al. 1998) and in the eastern Great Lakes (Ellis and Deller 1997; Gramly 1988). Biface types include finished fluted points, failed preforms, possible "backed" bifaces, and, rarely, large platter-like bifaces. Other formal tools consist of hafted and hand-held unifaces with distal and lateral working edges (end- and sidescrapers). Unhafted expedient tools, made on higher-grade toolstone and with likely short use lives, include flake gravers and utilized flakes. Expedient implements of rough stone may also be present in small numbers (e.g., Gramly and Lothrop 1984). At some sites pièces esquillées are recorded, although not commonly, and the functions of these bipolar artifacts remain uncertain (Lothrop and Gramly 1982; Shott 1989, 1999).

Ellis and Deller (1988) have recorded rare as well as more common Paleoindian tool forms in southwestern Ontario. They argue that the distinctive morphologies on several of the less common tool forms (e.g., narrow and offset endscrapers, hafted perforators, backed bifaces, backed and snapped tools) suggest functional specificity—a persuasive working hypothesis, testable with use wear and residue studies. Functional issues aside, Ellis and Deller (1997:Table 5) demonstrate that several of these rare tool forms are diagnostic of Paleoindian occupation in southwestern Ontario and in some cases are markers for individual phases represented by the Gainey-Barnes-Crowfield point sequence. For example, pièces esquillées are present on Gainey sites but not on later Barnes (Parkhill) and Crowfield phase occupations. Conversely, miniature fluted points made on channel flakes, beveled bifaces, backed bifaces, and hafted perforators are present at Parkhill sites but absent at Gainey sites. Beveled and backed bifaces are recorded for Crowfield sites, but points on channel flakes and hafted perforators are not.

In the New York region, we are just beginning to identify less common tool forms which, along with fluted bifaces, may be markers for Paleoindian occupations. Narrow endscrapers and hafted perforators, for example, have been noted (Lothrop 1988; Lothrop and Gramly 1984). Moreover, we are uncertain as to what extent morphological tool types correlate with the point sequences defined for the eastern Great Lakes and Far Northeast. Analysis and reporting of systematically recovered collections will ultimately place us on firmer ground.

Paleoindian sites in New York and the Far Northeast have a role in larger debates about the organizational nature of late Pleistocene technology in North America and how this technology was mediated by mobility strategies, toolstone procurement, and other factors. For North America, Parry and Kelly (1987) have argued that Paleoindian practices of standardized core reduction and reliance on portable biface cores enabled high residential mobility. Kelly and Todd (1988) further suggest that reliance on a portable biface technology allowed Paleoindians to maximize the utility of their transported stone (although some researchers dispute elements of this model, e.g., Bamforth [2002]; Prasciunas [2007]). Some researchers have proposed similar models of Paleoindian technology for the Far Northeast

and mid-Atlantic regions, suggesting a reliance on biface cores to support high residential mobility (e.g., MacDonald 1968; Parry 1989; Verrey 1986).

Viewed through the prism of eastern North America, Goodyear (1989) argued that the Paleoindian practice of high mobility created logistical and situational risks—that is, not having the necessary tools (or toolstone to make tools) at disparate task locations. In this context, he argued that the Paleoindian emphasis on high-quality toolstone provided the solution, permitting Paleoindians to create portable, flexible technologies in which tools could be recycled or reworked into new tool forms as situations demanded.

Organizational studies of fluted point assemblages in the eastern Great Lakes have considered evidence for fluted point stone technology as products of advance planning (e.g., Deller and Ellis 1992; Ellis 2008; Lothrop 1989). These analyses suggest that Early-Middle Paleoindians adhered to a highly segmented reduction sequence to produce standardized tool blanks and preforms for specific morphological tool types. At quarry-related sites, Paleoindians performed early- through late-stage reduction, in part to minimize the weight of the transported toolkit. Departing these quarry-related sites, Paleoindians took away stocks of finished tools, standardized tool blanks, and biface preforms, thereby ensuring sufficient numbers of stone tools and tool blanks of appropriate form for later use until the next lithic source visit. This planned production of the transported toolkit at the lithic source, including finished as well as unfinished tools and blanks, likely provided the flexibility for future tool-using activities.

What role did large bifaces play in Paleoindian stone technology? These artifacts—sometimes referred to as "platter-like bifaces"—are found rarely on sites in New York and the broader region (e.g., Gramly and Lothrop 1984:Figure 5c; Spiess 1990:68–72). This large biface form is also distinguished by very high width-to-thickness ratios of 10:1 or greater and, where discovered, may be diagnostic of early Paleoindian occupations in the Far Northeast.

Counter to the traditional technological model, however, organizational analyses of some eastern Great Lakes sites suggests that, after departing toolstone sources, Paleoindians did not rely on these large portable bifaces as primary sources for tool blanks. Rather, remnant blank attributes show that early Paleoindians made most formal tools on blanks generated from tabular or block cores at the lithic source, carrying them away from quarry-related sites near lithic sources (Deller and Ellis 1992; Ellis 1984; Lothrop 1989). At Potts only expedient, short use life tools like flake gravers and utilized flakes were produced, primarily from bifaces during on-site reduction of preforms to finished fluted points (Lothrop 1989). Experimental research supports these findings, showing that biface cores are not the most efficient producers of flake tool blanks (Prasciunas 2007).

Recent studies of early Paleoindian assemblages in the Hudson Valley support some elements of this basic model. Funk (2004) shows how Paleoindians at West Athens Hill reduced bifaces from early-stage forms to fluted points and preforms. Bradley et al. (2007) document a similar reduction sequence for bifaces at Kings Road and Swale and a separate sequence whereby Paleoindians systematically reduced angular or blocky cores, yielding thick, expanding, and sometimes bladelike flakes for unifacial tool blanks.

At the same time, these studies remind us of the potential for regional variability in organizational aspects of this fluted point technology. For example, a 2010 preliminary reanalysis of the Twin Fields collection (Eisenberg 1978) shows that flake gravers there were manufactured on both blanks from blocky or tabular or cores and on flakes from bifaces. Further, these graver bits sometimes appear on tools with sidescraper working edges (see figure 2.10, top row). Such observations highlight potential for interregional variation in these late Pleistocene technologies and reinforce the need for comparable analyses of Paleoindian sites to detect technological variation across space and time.

Early Paleoindians in eastern New York may have also used complementary strategies such as utilitarian or "secular" caching (sensu Deller et al. 2009) to ensure availability of usable stone tools between visits to lithic sources. Upwards of twenty caches of Clovis stone tools have been recorded in the Midwest and West (Beck and Jones 2010). Meltzer (2002:38–39, 2004:128) argues that such caching of stone artifacts was important for Clovis groups colonizing new regions where toolstone sources were not yet known. Alternatively, Haynes (2002:261–262) and Storck and Tomenchuk (1990) propose that the stone tool caches perhaps served to even out the patchy distribution of toolstone

across annual ranges, after groups had become familiar with source locations. Where recorded, caches may imply repetitive land use or the existence of true home ranges for some Clovis groups (Haynes 2002:261). In this perspective, caching provides a means for "provisioning the landscape" as a sort of toolstone insurance policy, perhaps both during and after colonization.

In the broader Northeast, recorded examples of Paleoindian caches are relatively rare (Beck and Jones 2010). In the eastern Great Lakes these include probable caches of fluted points at the Lamb site (Gramly 1998) and Thedford II site (Deller and Ellis 1992); a cache of unifacial tools and blanks at the Udora site (Storck and Tomenchuk 1990); and a group of large bifaces in the Hatt cache (Beck and Jones 2010).

We are aware of one confirmed lithic cache associated with fluted point groups in the Far Northeast, discovered at the DEDIC (Sugarloaf) site (Gramly 1998). The Aziscohos biface and a second large biface, reportedly found together in northwestern Maine, could represent a second cache, but uncertainty surrounding this discovery makes its assessment problematic (Spiess 1990). The stone tool cache at the DEDIC site weighs 960 g and includes a fluted point preform, an unfinished fluted point (broken in fluting), and 31 additional implements, consisting mostly of flake blanks, each of which could be transformed into a formal tool (Gramly 1998). Several specimens in this early Paleoindian cache are likely made of Normanskill chert from source outcrops 100 km to the west in the Hudson Valley. Unlike broken tools discarded at a camp site, caches such as DEDIC provide a unique glimpse of some elements of toolkits that Paleoindians likely carried away from quarry reduction sites such as Kings Road and Swale. Future discoveries may shed new light on the relative importance of caching for Paleoindian groups in New York and the glacial Northeast.

PALEOINDIAN SUBSISTENCE ADAPTATIONS

Long-running debates over subsistence adaptations for North American Paleoindians have focused largely on High Plains data sets and tended to dichotomize Paleoindians as either specialist hunters of megafauna (Haynes 2002; Waguespack and Surovell 2003) or generalist foragers (Byers and Ugan 2005; Cannon and Meltzer 2004; Dincauze 1993; Walker and Driskell 2007). For decades, the view of Paleoindians as specialized hunters has supported the interpretation that human overkill led to end-Pleistocene extinctions of megafauna (e.g., Martin 1967, 1984; Surovell and Waguespack 2009).

Collins (2007) suggests that in the southern High Plains there is generally accepted evidence for Folsom as a specialized bison-hunting subsistence base, but faunal evidence for earlier Clovis occupations at several sites documents a diverse subsistence base which, along with hunting of mammoth, bison, and horse, included other large-to-small mammals, reptiles, birds, fish, and amphibians as prey. He suggests that the earliest Paleoindians on the southern High Plains were indeed generalist foragers, more akin in this regard to mid-Holocene Archaic groups than to Folsom bison hunters.

Closer to home, Gingerich (2011) reviews evidence for Paleoindian subsistence in the upper Delaware Valley at the Shawnee Minisink site and concludes that there is a compelling case for consumption of berries and nuts, and perhaps fish, at this site. He cautions, however, that in isolation these data are insufficient to conclude that early Paleoindians in the upper Delaware Valley were generalist foragers (Gingerich 2011:141).

Clearly, future debates on this matter need to avoid monolithic characterizations and to recognize the potential for variability in Paleoindian subsistence strategies at different spatial scales (Cannon and Meltzer 2010), across time, and seasonally. For example, subsistence practices at Shawnee Minisink circa 12,900 cal BP may have differed significantly from those of Early Paleoindians who perhaps only a few generations later colonized the very different Younger Dryas landscapes of eastern New York and the Far Northeast.

Direct subsistence data for Early and Middle Paleoindian sites in New York and the broader Northeast remain limited (Spiess et al. 1998). Much discussion has focused on possible hunting of large herd animals, especially caribou. Based on climatic and vegetational shifts in the late Pleistocene, Newby et al. (2005) propose that during the Younger Dryas ecological and vegetational changes fostered habitats favorable to caribou in the Far Northeast. A handful of

sites in southern Ontario and elsewhere have yielded faunal remains of this species, as well as cervid (Robinson et al. 2009; Storck and Spiess 1994). Gramly (1982, 1984, 2010) provides a strong circumstantial case for hunting of herd animals (presumed caribou) at the Vail site in northwestern Maine. Other proxy evidence for caribou procurement (as well as other mammalian species) derives from residue analysis of fluted points at the Nobles Pond site in eastern Ohio (Seeman et al. 2008). As Storck and Spiess (1994:136) note, across space and time, and seasonally, Paleoindians could have engaged in a range of strategies for caribou hunting, from focused to opportunistic.

Faunal evidence for other mammalian prey species in the Northeast (perhaps not subsistence related) includes remains of beaver, arctic fox, and arctic hare (Storck and Spiess 1994). Dincauze and Jacobson (2001) speculate about the importance of migratory birds for Paleoindians in the Maritimes far northeast. To date, the only possible evidence for avian exploitation is the reported recovery of turkey feather fibers from a rock cluster feature attributed to the fluted point component at the Higgins site, located on the Western Shore of Maryland (Ebright 1989, 1992). Unconfirmed reports of fish remains at Shawnee Minisink (Dent 2007; Gingerich 2011) are consistent with fossil evidence for fish populations colonizing ponds and streams in northern New Jersey from Atlantic refugia, beginning circa 14,500 cal BP (Daniels and Peteet 1998; Peteet et al. 1993).

In New York, archaeological excavations at Dutchess Quarry Caves 1 and 8, located in the uplands of Orange County, yielded Paleoindian and Archaic artifacts, along with late Pleistocene and Holocene faunal remains, the former including caribou, flat-headed peccary, and giant beaver (Funk and Steadman 1994). Older-than-expected AMS radiocarbon dates for these late Pleistocene fauna led the investigators to conclude that the faunal materials predated the Paleoindian archaeological remains and were not associated (Steadman et al. 1997).

The Wallkill Valley's "Black Dirt" region in southeastern New York contains a rich record of late Pleistocene fossil mammals. Orange County records one of the highest concentrations of fossil mastodons in North America, to date numbering at least 41 specimens (Thompson et al. 2008). But east of the Mississippi, widely accepted evidence for early Paleoindian predation of mastodon is slim (Graham and Kay 1988; Laub 2003), leaving persistent questions about the nature of human-mastodon interaction in New York and the broader Northeast.

Robinson and coworkers link the late Pleistocene decline of megafauna (primarily mastodon) in southeastern New York to human impacts (Robinson et al. 2005; Robinson and Burney 2008). They rely on radiocarbon-dated pollen cores to track paleoenvironmental change versus two proxy measures in these cores: frequencies of the dung fungus spore genus *Sporormiella* (presumed to be a measure of megaherbivore abundance), and frequencies of microscopic charcoal (a gauge of local late Pleistocene fire frequency or intensity). At four study sites, Robinson and colleagues reported a decrease in *Sporormiella* abundance at circa 14,000 cal BP, which they interpret as evidence of mastodon population decline because of overkill hunting by humans (prior to final extinction ca. 12,000–11,500 cal BP). They record subsequent increases in charcoal frequency in pollen cores and interpret this as indicating intentional landscape burning by early humans, which further stressed mastodon populations. They conclude that humans were the prime agent in late Pleistocene mastodon extinctions in southeastern New York.

This research is reviewed in more detail elsewhere (Feranec et al. 2011). Here, we simply note that there is no cultural evidence, in southeastern New York or the rest of the Far Northeast, for human colonization prior to about 12,900 cal BP (Bradley et al. 2008; Steadman et al. 1997). Without archaeological evidence for a human presence at 14,000 cal BP (when they suggest overkill hunting of mastodons begins), their extinction argument is difficult for us to accept.

Western New York has also produced abundant evidence of late Pleistocene megafauna. Genesee County likely records the second-highest concentration of fossil mastodons in New York, due in part to long-term investigations at the Hiscock paleontological and archaeological site (Laub 2002, 2003; Laub et al. 1988). Excavations at Hiscock have recovered mastodon most commonly, as well as stag moose, caribou, and giant beaver. Geochemical analyses suggest that mastodons were attracted to this site because of its salt spring vents (Ponomarenko and Telka 2003). Hiscock also bears evidence of human use and probable human-mastodon interaction. Late Pleisto-

cene stone artifacts found at Hiscock include Gainey-like fluted points, a spurred endscraper, a scraper fragment, and a sandstone bead (Ellis et al. 2003; Laub 2002). Distinctive modifications to fluted point foresections include notching on lateral margins of four points; microwear analysis suggests that these modified points were used for hide and ligament slicing—a subset of butchering activities. The current interpretation holds that Paleoindians visited Hiscock to scavenge dead or dying mastodons (Ellis et al. 2003; Laub and Spiess 2003).

This more nuanced perspective on Paleoindian-mastodon interactions finds support in Haynes's (2002:209–212, 2006:20–25) actualistic field studies on elephants in Africa. There, proboscidea create trail networks between waterholes, forage locations, and other resource areas. These trail networks become deeply incised in the landscape and are easy for humans to follow. Further, dung boluses left on these trails by moving elephants can provide detailed information on when elephants last used the trail; their direction and speed at that time; and the age, size, and health of these individuals. If mastodons created similar trail networks in late Pleistocene New York, this could have provided human foragers with detailed, time-sensitive information on possible mastodon prey or scavengeable carcasses at locations like Hiscock. Haynes's studies, together with recent findings at Hiscock, suggest that this site is probably not unique on the New York landscape, and that similar localities await discovery.

SUMMARY AND CONCLUSIONS: REGIONAL PERSPECTIVES ON THE HUDSON VALLEY AND EASTERN NEW YORK

Until recently, the work of William Ritchie, Robert Funk, and their associates has been the primary basis for our understanding of Paleoindians in New York State. However, over the past twenty years several factors have begun to alter our interpretations of the Pleistocene-Holocene transition in northeastern North America and how human colonization and settlement fit into that complex set of environmental changes.

A primary factor has been the recent discovery and increased reporting of new Paleoindian sites and isolated finds across New York and the Far Northeast. This, in turn, has shifted our focus away from viewing individual sites in isolation toward more comprehensive studies of sites and isolated finds, helping to reveal both landscape use and other adaptive behaviors.

Concurrent with building a more robust archaeological database, a veritable revolution has occurred in our understanding of the region's environmental context. This includes more precise dating for ice retreat, the formation and draining of glacial lakes and the Champlain Sea, and other large-scale events which, literally, reshaped the New York landscape, setting the stage for human colonization. Little of this information was available to Ritchie and Funk, and thanks to our earth scientist colleagues we now see that many of these events occurred much closer in time to the arrival of the first human colonizers than was previously thought.

Adding to our understanding of the late Pleistocene landscape, major advances in the study of pollen and plant macrofossils have made it possible to reconstruct plant communities and even biomes in a way not possible before now. As well, many of these studies have come together to give us an increasingly fine grained understanding of the Younger Dryas climatic reversal (12,900–11,600 cal BP), with even glimpses into its subregional variability in terms of both temperature and moisture and the resulting effects on tree and plant and faunal communities. Taken together, this progressively more detailed record of the late Pleistocene environment provides a far better foundation on which the archaeological data from the period can be modeled for both New York and the broader region.

Another significant change in Paleoindian studies has been a move toward interpreting the archaeological data from New York in these broader regional contexts. As both the archaeological and environmental records have become more robust, so has our ability to define more precise geographic, temporal, and technological frameworks.

From a statewide perspective, we see that New York's Paleoindian data do not easily fall into neat geographic categories. However, in a context of regional patterns many of the more puzzling issues fall away. The New York region is actually split between two, and perhaps three, distinct geographic and cultural regions: to the east, the Far Northeast region includes the Mohawk/Hudson and Champlain

lowlands of New York; to the west, the eastern Great Lakes region incorporates the Erie-Ontario Lowlands. It may be that during Paleoindian occupations the Southern Tier of the Appalachian Plateau (including the upper Susquehanna and Delaware drainages) actually bore stronger cultural connections with the mid-Atlantic region to the south. At present, it seems safe to say that what we now call eastern New York State served as the late Pleistocene gateway to the Far Northeast and that all the major corridors that provided access to and from lands farther east ran through it. As our data sets grow stronger and regional collaborations (embodied by this volume) strengthen, our understanding of these late Pleistocene cultural dynamics will certainly improve.

Returning to the eastern New York focus of this chapter, to us this review highlights the potential for variation in Paleoindian adaptations and their material remains. In an earlier review of northeastern Paleoindian research, Ellis (1994) remarked on what he saw as a too frequent lack of concern with variability through time and space, leading to homogenized interpretations of late Pleistocene lifeways. He stressed the need to "actively seek out variability in the archaeological record and carefully delimit the scope of our generalizations" (1994:416). This extended to methods of investigation and analysis, including the need to (1) explore different kinds of sites, (2) identify variability in artifact assemblages through space and time, (3) refine both relative and absolute dating chronologies, and (4) collaborate more closely with earth scientists. In eastern New York, we have certainly made strides of late, but Ellis's comments remain relevant today, and we do well to heed them as we move forward.

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CHAPTER III

Maritime Mountaineers

Paleoindian Settlement Patterns on the West Coast of New England

John G. Crock and Francis W. Robinson IV

This chapter provides a brief description of the majority of the recorded Paleoindian sites and well-documented fluted point finds in Vermont. The intent is to provide an overview of the cultural affiliation, settlement type, content, and location of sites and finds for the purposes of understanding human colonization and early settlement in the region. The sources of this information include the Vermont Archaeological Inventory (VAI) maintained by the Vermont Division for Historic Preservation (VDHP), unpublished technical reports, our own research, in addition to published articles and books. Summaries of several sites are formally published here for the first time.

One of the unfortunate features of the Vermont Paleoindian site inventory is an almost complete lack of radiometrically dated sites. With the exception of one dated site marking the beginning of the Early Archaic period, all the sites presented herein are attributed to the Early, Middle, or Late Paleoindian periods based on relative dates derived from comparative stone tool morphology. Projectile points are used exclusively to avoid more tentative attributions. Bradley et al.'s (2008) Paleoindian projectile point chronology for the Far Northeast region is used to assign sites to temporal subperiods. Their excellent work, anchored by numerous dated sites in the Northeast, provides locally relevant relative dates for projectile point forms once only comparable to point types identified in western North America and the Great Lakes region (e.g., Deller and Ellis 1992; Ellis and Deller 1997).

When the first Paleoindian sites in Vermont were discovered they were, by necessity, interpreted through the lens of historic precedents in the western United States (Ritchie 1953, 1957, 1969). Although comparisons across North American assemblages still pertain to some degree, regional data, particularly including the refined typology proposed by Bradley and others (2008), are sufficient to allow a meaningful treatment of Paleoindian settlement within a geographically restricted area. This chapter represents the first real update of the inventory of Paleoindian sites in Vermont since Loring's (1980) seminal paper exploring the association between Paleoindian sites and the Champlain Sea. We have (thankfully) made significant progress in many areas since the publication of Loring's paper thirty years ago.

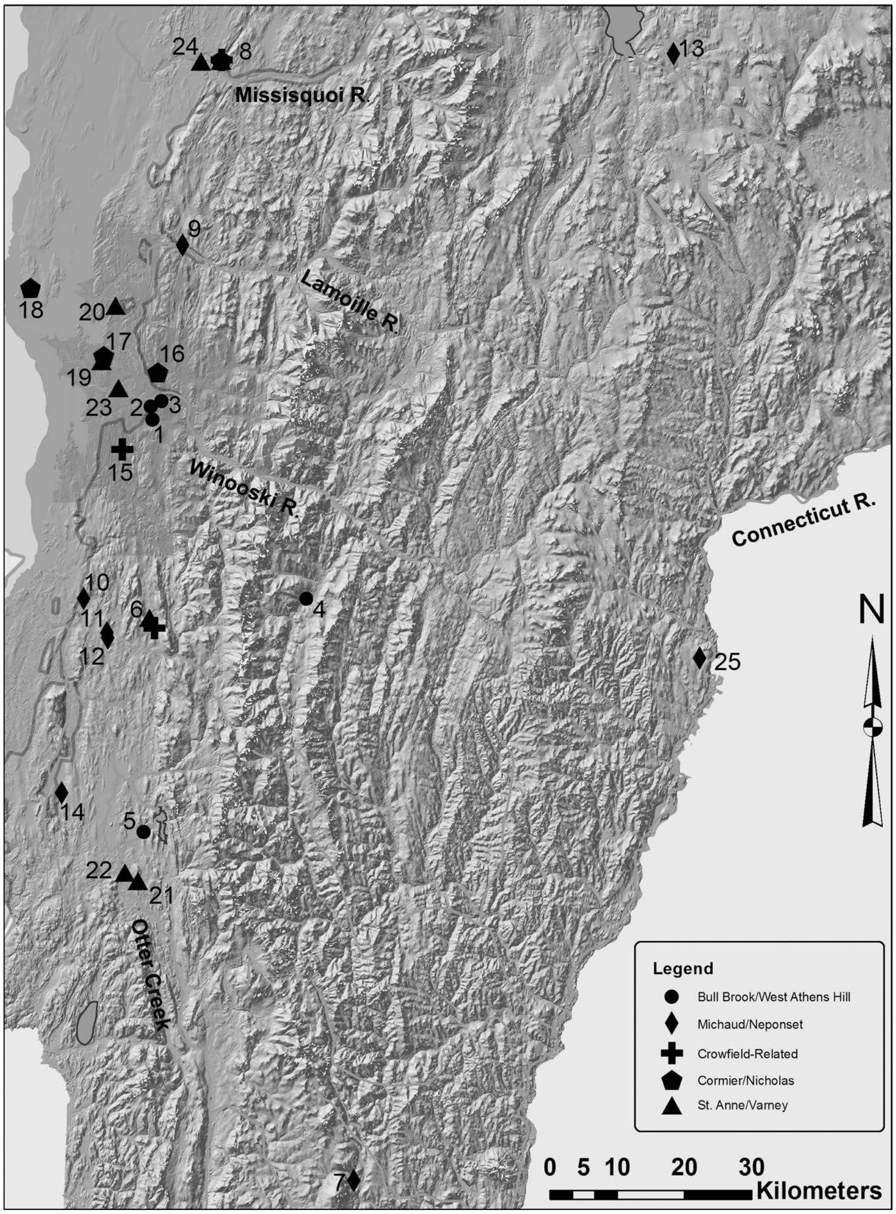
First, as discussed in detail in F. Robinson's chapter 10, the inception and duration of the Champlain Sea have been revised significantly to include a substantial or perhaps even complete overlap with the dates of Paleoindian presence

in Vermont (e.g., Cronin et al. 2008; Rayburn et al. 2005, 2007; Richard and Occhietti 2005; Ridge 2003; Ridge et al. 1999; Rodrigues 1988). This body of work substantiates Ritchie's originally proposed (1957, 1969) and Loring's (1980) presumed association between Paleoindian populations and the inland ocean. In parallel, several sites in the Far Northeast have been radiocarbon-dated, and those dates, properly calibrated, provide a more rigorous typology for Paleoindian stone tools in the region (Bradley et al. 2008). Paleoenvironmental reconstructions for New England also have shown that the landscape was not the barren tundra once thought but rather well forested (e.g., Newby et al. 2005). This work enables an updated view of the natural environment in which Paleoindians lived, one that was more diverse and more productive than once thought.

Second, several Paleoindian sites also have been systematically excavated by professionals, providing archaeological context and associated tools and materials to expand our knowledge of Paleoindian sites beyond spot finds of fluted points. Within the past two decades, two Early Paleoindian and at least four Late Paleoindian sites in Vermont have been identified as a result of systematic studies within professional, regulatory contexts. This increases by 400 percent the number of Late Paleoindian sites known prior to 1990, when it was thought that, barring the enigma of Reagen, Vermont was largely uninhabited during this period. This systematic work also has generated highly valuable artifact associations and distributions as well as accurate locational information, thus adding critical settlement pattern data to the previously known Paleoindian site inventory.

Third, the identification of raw material sources has improved dramatically as a result of both technological advances and increased communication between researchers in the region. These data are essential to the reconstruction of interregional travel and interaction, moving from speculation to more accurate and quantifiable assessments. For example, many artifacts once thought to have been made of a local (Colchester, Vermont) red "jasper" at the time Loring (1980) published his work are presently interpreted as more likely attributable to source locations at Munsungun Lake in northern Maine. Through the 1970s and 1980s, fine-grained red material found in Vermont assemblages was believed to be from a Jasper quarry source in Colchester, primarily because the source seemed so close at hand (Lavin and Prothero 1987; Robinson and Crock 2008; Thomas and Robinson 1980). Other than anecdotal reports of some Woodland period scraping tools being made from this material, however, there is little evidence of Colchester jasper being used by Native American groups from any recognized precontact period. More recently, the Munsungun chert quarry has been geologically examined (Pollock 1987; Pollock et al. 1999) and archaeologically explored (Bonnichsen 1982) and is now recognized as perhaps the most heavily utilized chert source in northern New England during the Early Paleoindian period (Pollock et al. 1999; Spiess et al. 1998). A similar increase in knowledge has occurred for rhyolite quarried in New Hampshire. Though a quarry for the material at Mount Jasper in Berlin has been known for over a century (Gramly 1977, 1980, 1984; Gramly and Cox 1976; Pollock et al. 2008), only recently was the material determined to be the source of the spherulitic rhyolite common in Paleoindian assemblages (Boisvert 1992; Pollock et al. 2008; Spiess et al. 1998). More recently, Boisvert (1998) discovered similar rhyolite exposures in Jefferson, New Hampshire, which also appear to have been utilized by Paleoindian groups. Although Mount Jasper rhyolite and the Jefferson rhyolite are similar and are likely of a similar geological age, there are demonstrable petrographic differences and a significant geographic distance between them (Pollock et al. 2008). Material from one or both of these sources appears in both Early and Late Paleoindian contexts in Vermont.

Beyond those sites reported herein, several other recorded sites likely date to Paleoindian periods based on fluted points in collections and reports of fluted point recoveries. For the purposes of this chapter, however, spot finds without clearly defined, verified provenience are not discussed, including several Vermont fluted points with less specific provenience reported by Loring (1980). In addition, there are numerous sites in the VAI listed as Paleoindian which, upon closer scrutiny, have not yielded artifacts that unequivocally can be assigned to Paleoindian periods. For example, there are recorded sites for which tentative associations have been made based on tool types such as spurred scrapers, the presence of certain exotic raw materials that correlate well with early sites in Vermont, or sites' environmental settings (e.g., high terraces on the edges of major river valleys). Although these sites may likely date



3.1. Map of Vermont showing the location of Paleoindian sites and spot finds discussed in the chapter and the estimated Champlain Sea paleoshoreline at its maximum. Sites and finds are numbered in order of mention in the text: 1, Mahan; 2, Reynolds; 3, Bishop; 4, Mad River; 5, Leicester Flats; 6, Bristol Pond; 7, Jackson-Gore; 8, Reagen; 9, Fairfax Sandblows; 10, Hinsdale; 11–12, Little Otter Creek; 13, Lake Salem; 14, VT-AD-679; 15, Auclair; 16, VT-CH-230; 17, Paquette 2; 18, South Hero; 19, Mazza; 20, Arbor Gardens; 21, Arnold Brook; 22, Otter Creek 2; 23, Winooski Redevelopment; 24, Bessette II; 25, VT-OR-89 (base map source: Vermont Center for Geographic Information).

to one or another Paleoindian subperiod, they remain less than certain attributions. Still other sites listed as dating to the Paleoindian period in the VAI are not included here because their temporal assignment could not be supported by our own firsthand examination of the artifacts. These include several sites, for example, where basally thinned triangular points are cited as temporally diagnostic of the Paleoindian periods. Most of these forms likely date to more recent eras, including instances where Levanna triangles with basal thinning are misinterpreted as fluted points by site reporters.

A total of twenty-five sites/finds in Vermont are included here as unequivocally attributable to the Early, Middle, or Late Paleoindian periods based on the presence of specific projectile point types confirmed by our inspection or for which illustrations and reliable, verified provenience information exist (figure 3.1).

Rather than a truly representative sample of settlement patterns from this period, the distribution of sites statewide is admittedly more a product of where regulatory surveys and artifact collecting have taken place. Clearly, many early sites have been lost and still more sites remain unidentified, particularly in less-developed portions of the state. The inventory is lacking well-documented Paleoindian pe-

riod sites on the Vermont side of the upper Connecticut River drainage, for example, and, based on sites such as Colebrook (see Boisvert, this volume), this appears to be a sampling issue on the Vermont side of the valley. Despite the gaps in the record, the locations of presently known sites provide a representative sample and do show a clear association with a narrow range of environmental settings including, for example, the boundaries of the Champlain Sea (Loring 1980; F. Robinson, this volume), relict glacial ponds and "kettles," valley edge terraces along major rivers, secondary stream valleys, and upland transportation corridors. The inventory of sites reported here is but a snapshot in time, presented with the understanding that this inventory will change in the future. Indeed we are hopeful that it will not require another thirty years before another assessment can be made of early human settlement in what is now Vermont.

VERMONT SITES ATTRIBUTABLE TO PALEOINDIAN PERIODS

Early Paleoindian Period, circa 12,900–12,400 cal BP

Following Bradley and others, we use an Early Paleoindian period subdivision for fluted points that match morphological characteristics associated with the earliest human occupations in the Far Northeast. Sites reported in this section have all yielded projectile points that resemble the Bull Brook/West Athens Hill form (Bradley et al. 2008). Interestingly, no projectile points attributable to the King's Road/Whipple or Vail/Debert subperiods defined by Bradley et al. (2008) have been identified in the state thus far. Although this may be a vagary of sampling or typology, it is also possible that environmental conditions at the earliest portion of the Paleoindian period were not amenable to human occupation in the Champlain Basin. Since the beginning of the Bull Brook/West Athens Hill subperiod is more or less synchronous with the inception of the Champlain Sea (F. Robinson, this volume), the possible absence of people in the Champlain Basin before this date may provide indirect evidence that the productivity of the Champlain Sea was a compelling factor in the initial colonization of the region. If Paleoindians were in the region to experience and exploit the inception of the sea, their presence on the west coast of New England attests to the remarkable ability of Paleoindians to respond to profound environmental changes in relatively short order, as does their adaptation later on to the water body's transition to a freshwater lake.

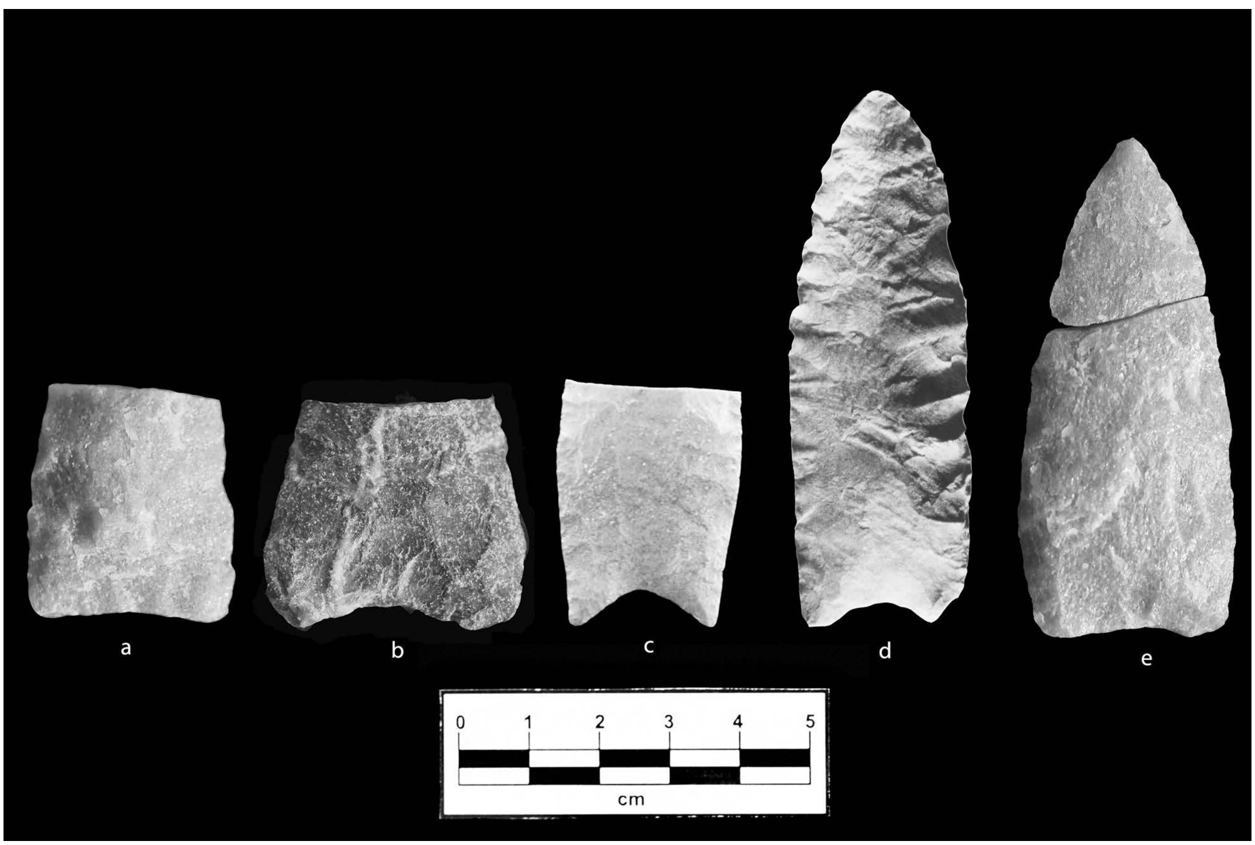
MAHAN SITE (VT-CH-197)

The Mahan site is the largest known Paleoindian site in Vermont and also the most extensively excavated. The site is located in Williston on a peninsula of land which, based on its elevation, once may have extended into an embayment along the eastern shore of the Champlain Sea (see figure 3.1, site 1). The site is situated on a gentle slope on the south side of a knoll at an average elevation of about 125 m (410 ft). The site area overlooks Allen Brook, which is now a tributary of the Winooski River but when the site was occupied likely emptied directly into the sea. The Mahan site was first identified by the University of Vermont Consulting Archaeology Program (UVM CAP) during a regulatory survey conducted for the proposed Chittenden County Circumferential Highway (CCCH) (Thomas 2002; Thomas et al. 1998). Shovel test pit and test unit sampling and block excavation were conducted during three phases of fieldwork at the site.

Based on surface finds and positive test pits, the site covers an estimated 18,144 m^2 (1.8 ha), with the majority of artifacts recovered from an approximately 5,940 m^2 (0.6 ha) core area (Thomas et al. 1998). Altogether, a total of 359 m^2 ultimately were excavated and 5,846 artifacts were recovered (Thomas 2002). The artifact inventory includes 122 stone tools, with one mended fluted projectile point, made of local Vermont "Cheshire" gray quartzite (figure 3.2e) and a small tang of another projectile point that appears to be made of chert from the Hudson Valley. The complete point falls into the Bull Brook/West Athens Hill group on the basis of its general size, fluting, and shape and thus the site likely dates to 12,900–12,400 cal BP. A recent inspection of the unfinished tools in the assemblage has also identified at least three fluted or basally thinned preforms made from Cheshire quartzite (figure 3.3). Though fluted preforms have been identified at other sites, they are a notable component of the Mahan site assemblage and help document how knappers worked the quartzite by thinning the central portion of the tool early in the reduction process, well in advance of final thinning and blade preparation.

Other than the complete but mended fluted point and the tang of another point made from probable Hudson Valley chert, the tool inventory shows little evidence of the final stages of fluted point manufacture at the site (e.g., channel flakes, late-stage preforms, or points broken in manufacture, but see figure 3.2 for the few several fragmentary examples). Similar to some other Paleoindian sites, however, a high percentage (79 percent; *n* = 43) of the tools recovered are scrapers of one or another type, most of which were manufactured from exotic cherts. Both end- (*n* = 37) and sidescraper (*n* = 6) types are represented, in addition to utilized flakes of chert and quartzite, also likely used for scraping tasks (figure 3.4). At least two of the endscrapers are "spurred." Several of the tools categorized as utilized exhibit modified notches and have been termed "notched oblique scrapers" and viewed as potentially diagnostic of the Paleoindian period (Robinson et al. 2004). Scraping tools, well-documented as part of the Paleoindian toolkit at other sites in New England, suggest a likelihood of wood-, bone-, or hide-processing activities at the site (Thomas 2002). Given the site's likely proximity to the Champlain Sea, these tasks may have been done to support fishing and marine mammal hunting or related processing activities, which also may explain the apparently limited stone projectile point inventory. Although there is evidence that the site was reoccupied, minimally during the Late Archaic period, the broad distribution of tools and debitage made from exotic raw materials suggests that the Paleoindian occupation was extensive.

The lack of nucleated loci and the wide but generally low-density distribution of tools and debitage (ca. 0.35 tools/m^2 and a mean density of 21 flakes/m^2) led Thomas to suggest that the site was occupied during the summer months as a base camp for one or two bands (Thomas 2002; Thomas et al. 1998). Seasonal population aggregations have been suggested by the distribution of materials



3.2. Bull Brook/West Athens Hill fluted projectile points and projectile point fragments from Vermont sites attributable to the Early Paleoindian period: a–b, one quartzite and one chert base from the Leicester Flats site (VT-AD-127); c, chert base and midsection from the Reynolds site (VT-CH-9210); d, complete Mount Jasper/Jefferson rhyolite point from the Bishop site (VT-CH-818) (photo by Peter Mills, courtesy of William Haviland); e, complete quartzite point from the Mahan site (VT-CH-197).

3.3. Quartzite projectile point preforms and biface fragments and chert biface fragments (three in upper right) from the Early Paleoindian Mahan site (VT-CH-197). Note specimens on bottom row that exhibit basal thinning or early-stage fluting.

at exceptionally large New England Paleoindian period sites, such as Bull Brook (B. Robinson et al. 2009). Unlike the situation at Bull Brook, however, the Mahan site artifact distribution is not well organized into smaller loci but rather evenly spread out, at least as currently understood. This characteristic is one of the main pieces of evidence that led Thomas to suggest that the site represents a summer base camp occupied by one or two bands, perhaps twenty-five to forty people, for an extended period. Occupation during the warmer months also correlates well with a seasonal exploitation of Champlain Sea resources (F. Robinson, this volume).

As at other sites in Vermont and the broader Far Northeast region, the Mahan tool assemblage features a significant percentage of exotic lithic raw materials, though local gray quartzite and black Champlain Valley chert (Robinson 2009) were the primary materials used for making projectile points. At least six varieties of exotic, nonlocal chert and yellowish brown jasper were also used, predominantly in the manufacture of the numerous recovered scrapers (see figure 3.4). Nearly half of the chert tools are macroscopically consistent with chert derived from the Munsungun Lake formation in north-central Maine (Thomas 2002, based on inspection by Pollock). Other cherts represented in the Mahan site tool inventory possibly originated in the Normanskill Formation that outcrops in the Hudson Valley to the southwest (Brumbach and Weinstein 1999; Hammer 1976; Wray 1948). The yellow-brown jasper likely derives from two potential source areas in southeastern and central Pennsylvania.

REYNOLDS SITE (VT-CH-9210)

The base/midsection portion of a fluted point was recovered during a surface collection in Williston by UVM CAP conducted for the CCCH project (Thomas and Doherty 1985). The site is located on a sandy outwash terrace on the south side of the Winooski River Valley (see figure 3.1, site 2), near an unnamed tributary at an elevation of approximately 107 m (350 ft). One worked quartz fragment was also recovered from the site but not in close enough

3.4. Chert scrapers recovered from the Early Paleoindian Mahan site (VT-CH-197). Top row: left to right, three weathered matte green, possible Hudson Valley, and two gray, probable Hudson Valley. Middle row: gray, probable Hudson Valley. Bottom row: left to right, two red and four black, probable Munsungun, and one yellow-brown, probable Pennsylvania jasper.

proximity to be associated with the projectile point. The point is made of chert, possibly a weathered Champlain Valley variety. Based on its lanceolate form, flaking, and basal concavity, the point fragment can be assigned to the Bull Brook/West Athens Hill group of Early Paleoindian forms (see figure 3.2c). At the time of occupation, the site was roughly 150 m east of the Champlain Sea shoreline, on the south side of a small point of land (see F. Robinson, this volume).

BISHOP SITE (VT-CH-818)

A complete fluted point was recovered in Williston by Randy Bishop from a sand and gravel pit on the north side of a hill overlooking the Winooski Valley to the north (see figure 3.1, site 3). The site lies at an approximate elevation of 145 m (475 ft) amsl. The point is likely manufactured from Mount Jasper/Jefferson rhyolite and, based on its size, lanceolate shape, and basal concavity, represents a Bull Brook/West Athens Hill form (see figure 3.2d). Accordingly, the point and site it represents likely date to 12,900–12,400 cal BP. At the time of occupation, the site would have been roughly 500 m from the Champlain Sea shoreline (see F. Robinson, this volume), near the head of a tributary stream and the Winooski Valley drainage.

MAD RIVER SITE (F.S. 7 WA/VT-WA-39)

A fluted point said to be recovered in Moretown during the construction of a "small building northwest of a barn" (VAI site files) was first reported by Fowler (1954) and later included in Loring's (1980) inventory of fluted points from Vermont. Fowler described the point as being "from a ridge, 1.5 miles south of the town, southeast of Swamp Brook" (VAI site files) (see figure 3.1, site 4). Based on Fowler's illustration (1954:5, no. 4), the "black flint" point is attributable to the Early Paleoindian period and resembles a Bull Brook/West Athens Hill form. The site location, though not precisely known, likely falls on an upper terrace "ridge" in the town of Waitsfield, on the east side of the Mad River

valley, based on the reported distance south of Moretown. An unnamed brook, likely the so-called Swamp Brook, is located in this vicinity, trending westward before turning north near the town line and draining into the Mad River. Based on this limited information, the find spot was at an elevation of at least 213 m amsl (700+ ft) amsl. The most valuable information provided by this point is more in its general location, within an upland valley near the Appalachian Gap, which likely served as a transportation corridor through the Green Mountains, connecting portions of the upper Otter Creek valley and the Champlain Sea to the west with the upper portion of the Winooski Valley and points farther afield to the east.

Leicester Flats Site (VT-AD-127)

The Leicester Flats site is located in Salisbury on the north side of the Leicester River, a tributary of Otter Creek that drains Lake Dunmore approximately 800 m to the east (see figure 3.1, site 5). The site lies approximately 61 m below the elevation of the upland lake, at approximately 107 m amsl (350 ft). The site is multicomponent, with virtually all precontact Native American periods represented. Two fluted projectile point bases in the Petersen family collection from the site are attributable to the Early Paleoindian period (F. Robinson et al. 2009). Both point bases, one of local gray quartzite and the other of Champlain Valley chert, exhibit fluting and basal morphology that most closely align with the Bull Brook/West Athens Hill typological group (see figure 3.2a, b). As a result, the earliest occupation at this multicomponent site can be dated to ca. 12,900–12,400 cal BP.

Bristol Pond Sites (VT-AD-11/VT-AD-160)

The Bristol Pond area in Bristol, Vermont, contains several multicomponent Native American archaeological sites frequented by artifact collectors but never systematically studied. Based on the size and number of reported collections alone, the sites surrounding Bristol Pond, formerly Lake Winona, are some of the most intensively collected sites in Vermont (see figure 3.1, site 6). Fortunately, several collections made from the Bristol Pond area have been fairly well documented. At least three collections, and likely others, contain fluted points attributable to the Paleoindian periods.

A gray quartzite base and midsection, fluted on one side, was collected by Dave Mumford from the northeast side of the pond, near the base of the Hogback Mountain portion of the Green Mountains. The find location, designated VT-AD-160 in the VAI files, lies at approximately 183 m (600 ft) amsl. Based on an illustration in the VAI files, the Mumford point fragment is attributable to the Early Paleoindian period and can be generally categorized as related to Bull Brook/West Athens Hill forms. At this time, the find location was likely much closer to the edge of the lake, since lake levels have gradually receded since the end of the Pleistocene. Frink (2004:23) estimates that "Paleo Lake Bristol" had an elevation of approximately 159 m (520 ft), roughly 12 m (40 ft) higher than its present level. Importantly, the site lies immediately adjacent to the main source zone for Vermont gray quartzite, also featured at the Early Paleoindian period Mahan site in Williston, attesting to the early use of this local material and a possible main source area for its wider distribution.

Loring includes an illustration of a narrow bladed, fluted point from a private collection, also attributed to the Bristol Pond locality; this point is described as made of "maroon-brown jaspar [sic]"(Loring 1980:30), but it is highly probable that, like other Paleoindian points and tools, this one is made from Munsungun chert, not a more local jasper material. Based on Loring's illustration, the point can be attributed to the Early Paleoindian period.

Middle Paleoindian Period, circa 12,200–11,600 cal BP

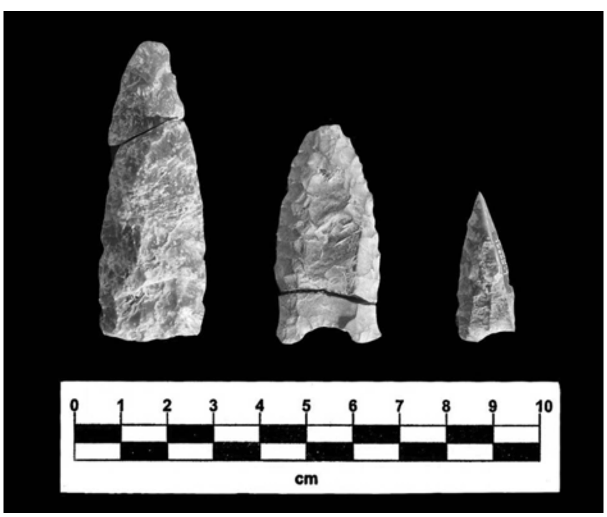
Following Bradley and others, we use a Middle Paleoindian period subdivision for fluted points that fit their well-reasoned morphological categories. Sites reported in this section have all yielded projectile points that resemble Michaud/Neponset, Crowfield, or Cormier/Nicholas forms (Bradley et al. 2008).

Jackson-Gore Site (VT-WN-289)

The Jackson-Gore site is located in the town of Ludlow in the southern Green Mountains and represents the most upland Paleoindian site presently known in Vermont (Crock and Robinson 2009). The site is situated on a high terrace at the base of Okemo Mountain at an elevation of 331 m (1,086 ft) amsl (see figure 3.1, site 7). The site overlooks Branch Brook, a major tributary of the upper portion of the Black River, which itself is a major tributary of the

Connecticut River in Vermont. The Jackson-Gore site was discovered by UVM CAP in 1999 during the course of a broader phase I survey of the Okemo Mountain Resort's Jackson-Gore ski area expansion. The site consists of two loci separated by approximately 96 m (314 ft). Locus 1, the larger of the two, is situated in the interior portion of the level terrace; a smaller activity area designated Locus 2 is closer to the terrace edge above Branch Brook. As a result of phased archaeological survey, testing, and mitigation at the site, a cumulative total of 49.5 m^2 has been excavated within Locus 1 and 8 m^2 has been excavated within Locus 2.

The tool assemblage at Locus 1 includes several fluted Champlain Valley chert projectile point fragments, among them a longitudinal fragment of a fluted point and a rough fluted point or late-stage preform that was articulated from two fragments. Two gray chert fragments also recovered in situ from two separate test units were articulated to form a complete fluted projectile point (figure 3.5). This articulated Jackson-Gore point represents the only Early or Middle Paleoindian period projectile point in Vermont recovered during a professional excavation from intact soils, in this case below a historically disturbed plow zone. The point formed by the two fragments can be assigned to the Michaud/Neponset group based on its moderately deep basal concavity, prominent basal ears, and elongated channel flake scars. Based on this affiliation, the site can be dated to circa 12,200–11,600 cal BP. Charcoal recovered from a feature stain in the vicinity of the point, which was recovered from beneath the upper plow-disturbed horizon at the site, unfortunately returned a date of only 5630 ± 40 BP (Beta-244965) which, calibrated at a two sigma error range, falls between 6490 and 6320 BP. The date is therefore considered contaminated, perhaps as a result of root activity.



3.5. Chert fluted projectile point preform, Michaud/Neponset type chert fluted point, and fluted point fragment recovered from the Jackson-Gore site (VT-WN-289), attributable to the Middle Paleoindian period.

The second, smaller site locus lies at the head of a swale closer to the edge of the terrace. A total of 8 m^2 of excavation here revealed a lithic scatter of nonlocal red chert debitage, possibly Munsungun chert. Two utilized flakes also were recovered from this smaller activity area, which may represent a hunting lookout.

The combined Locus 1 and Locus 2 site assemblage contains a diverse sample of lithic raw materials. Within the sample of lithic debitage recovered (n = 2,682), the most common material is a gray chert of unknown origin that may derive from the Hudson Valley (46 percent). This is followed by a red chert (26 percent) that is macroscopically similar to Munsungun chert from northern Maine. No chemical analysis had been conducted on these artifacts, however, so this attribution remains tentative. As represented in the projectile points, black chert, likely from the Champlain Valley, is well represented in the flakes and fragments recovered (21 percent). Local Vermont quartzite is present at the site as well, but not in significant quantities (3 percent), as are other unidentified cherts (2 percent). The inventory is rounded out by even smaller samples of a greenish chert macroscopically similar to Hudson Valley material (1 percent), a yellow-brown chert, macroscopically similar to Pennsylvania jasper (0.5 percent), quartz (0.5 percent), and a felsite, possibly from Mount Ascutney in Vermont.

The size of both the tools and the debitage recovered from the Jackson-Gore site suggests that tool stone supplies were limited and the group was in transit between source areas or other seasonal locales. The wide range of materials represented and their proportional breakdown could be indicative of direct acquisition during wide-ranging seasonal rounds or, more plausibly, a combination of direct acquisition and exchange. For example, the three most dominant materials—gray chert, red chert, and black chert from the Champlain Valley—may represent materials acquired from local Vermont sources, whereas the less-prevalent

materials such as the green chert and yellow-brown chert may represent material acquired via exchange with other groups.

The site's location certainly attests to travel between ecological zones/regions, over the Green Mountains and between the Champlain Sea and Connecticut River valley. The site's altitude also may be an indication of the season the site was occupied, or perhaps when it was not occupied. Deep snows in the higher elevations of the Green Mountains likely would have made travel through the mountain pass more difficult; on the other hand, deep snows may have assisted hunters. Ironically, the Jackson-Gore site is about 5 km (3.1 mi) east of the Mount Holly mammoth find spot (Agassiz 1850), one of the few recorded locations in Vermont where remains of Pleistocene megafauna have been recovered.

There is a second site on the property, also believed to date to the Paleoindian period (VT-WN-273) on the basis of the presence of red chert similar to that recovered from one of the Jackson-Gore site loci. It is located approximately 645 m (2,118 ft) north of the Jackson-Gore site on a narrow, boulder-strewn, glacial kame terrace at a slightly higher elevation of 353 m (1,160 ft) amsl.

REAGEN SITE (VT-FR-3)

The Reagen site in East Highgate is the best known of Vermont's Paleoindian sites. It is one of the first early human occupations recognized in the Far Northeast and the first in Vermont reported in the archaeological literature (Ritchie 1953; Wormington 1957). We describe this site only briefly here, since it is discussed extensively elsewhere (Robinson 2008, 2009, and F. Robinson, this volume). The Reagen site is situated on the southern side of an unnamed hill on the eastern side of the Missisquoi River valley at an elevation of approximately 76 m (250 ft) (see figure 3.1, site 8). At the time the site was first occupied, it was located at or near where the Missisquoi River emptied into the Champlain Sea, likely in general proximity to an estuarine environment. For the purposes of this chapter, the Reagen site produced 23 bifaces that were determined by Robinson (2008, 2009) to be diagnostic of multiple Paleoindian occupations during the Middle and Late Paleoindian periods, circa 12,200–10,000 cal BP. These include the Crowfield (*n* = 3), Cormier/Nicholas (*n* = 14), and Ste. Anne/Varney (*n* = 6) subperiods (figure 3.6) described below and four more that may be attributable to the Agate Basin subperiod, though we have serious reservations about the appropriateness of that taxonomic category.

The Reagen site continued to be occupied throughout the latter Paleoindian periods for several reasons, principally its proximity to the resources of the Champlain Sea, at least initially. One other notable attraction of the site, or at least of the general area, may have been that this locale was likely the source of the enigmatic Reagen chert, prominently represented in the Reagen assemblage but completely absent from other regional Paleoindian assemblages, at least as understood thus far (Robinson 2008, 2009). Ongoing research should better elucidate this aspect of the site.

FAIRFAX SANDBLOWS SITE (VT-FR-64)

The Fairfax Sandblows site is a site in Fairfax where several projectile points dating to the Middle Paleoindian period reportedly were collected by L. B. Truax in the early 1900s (Robinson and Crock 2008). Loring (1980) was the first "rediscoverer" of four fluted projectile points, which were part of the "Fairfax Sandblows" assemblage in the Benjamin W. Fisher collection at the University of Vermont Fleming Museum. The fluted points were reportedly taken from "sandblows" (destabilized sand deposits) in that town (Loring 1980; VAI site files). More recently, additional references to the collection in letters to or by Fisher curated at the American Museum of Natural History, the New York State Museum, and the Fleming Museum provide more context for the collection and help to better place the site on the landscape (Robinson and Crock 2008). It is also reasonably clear that several fluted points collected from the site by Truax ended up in the Manley collection and were sold at auction in the 1990s (though fortunately studied by the late James Petersen beforehand). Based on the available information, the site, described by Fisher as being 14 miles from the mouth of the Lamoille River and 100 feet above the river, may have been situated on an estuary when occupied (see figure 3.1, site 9). At an elevation of approximately 160 m (525 ft) amsl, the site may have been very close to both the ancient mouth of the Lamoille River and the shoreline of the Champlain Sea, depending on the effects of isostatic rebound.

Based on macroscopic examination, all of the points or

3.6. Projectile points in the University of Vermont Fleming Museum and Bixby Library collections from the Reagen site attributable to the Middle and Late Paleoindian periods. Top row, Crowfield type; middle row, Cormier/Nicholas type; bottom row, Ste. Anne/Varney type.

point fragments in the Fisher collection at the University of Vermont are made from Mount Jasper/Jefferson rhyolite, derived from quarries in and around Berlin or Jefferson, New Hampshire (Boisvert 1992; Pollock et al. 2008; Spiess et al. 1998). In addition, as Loring (1980) noted, all of these artifacts are quite ventifacted, or "sand blasted," from prolonged exposure to eolian processes. This abrasive action has resulted in excessive polish and has obscured the crystal structure of the material somewhat. This postdepositional process is also common in the Paleoindian Reagan artifact assemblage, which also was recovered from a sandy Champlain Sea margin context.

Four of the projectile points have a general tapered, triangular or "rocket"-like shape, with fluid lines trending from the widest point at the basal ears to the tip (figure 3.7a–d). Others in the collection may be representative of the same style, though one is quite small and is likely the result of reworking or expediency and another is represented only by an eared base (figure 3.7e–f). Those that were not apparently heavily reworked are still smaller than the average provided by Bradley et al. (2008) for the Michaud/Neponset points, though their measurements relative to each other are strikingly similar (figure 3.7g–i).

The particular stylistic variation these points exhibit is not common in the New England region, as far as we are aware. The projectile points depicted in the bottom row of figure 3.7 appear more like the "typical" Michaud/Neponset form, with close similarity to projectile points recovered from the Michaud site in Maine (Spiess and Wilson 1987) and a site near Lake Mégantic in Quebec (Chapdelaine 2004, 2007). Three of the five projectile points or point fragments from the Manley collection that are under consideration here macroscopically appear to be made from Munsungun chert, including one of mottled red and green chert (figure 3.7a), a variation of the material noted in other Paleoindian assemblages (e.g., Spiller Farm; Hamilton and Pollock 1996). Petersen, in his brief analysis of the points in the late 1990s, also suggested that the material was Munsungun chert. Therefore, although no petrographic or chemical sourcing was conducted on the artifacts in question, we feel

3.7. Michaud/Neponset projectile points attributed to the Fairfax Sandblows site (VT-FR-64). Artifacts a, d, f, g, and h formerly part of the Manley Collection, photographed by the late James Petersen. Artifacts b, c, e, and i in the University of Vermont Fleming Museum Collection, photographed by Francis Robinson.

confident that the material from which each of the projectile points was made is indeed Munsungun chert. Overall, the similarity of the Fairfax Sandblows site projectile point assemblage with Michaud/Neponset forms dates the site to the Middle Paleoindian period.

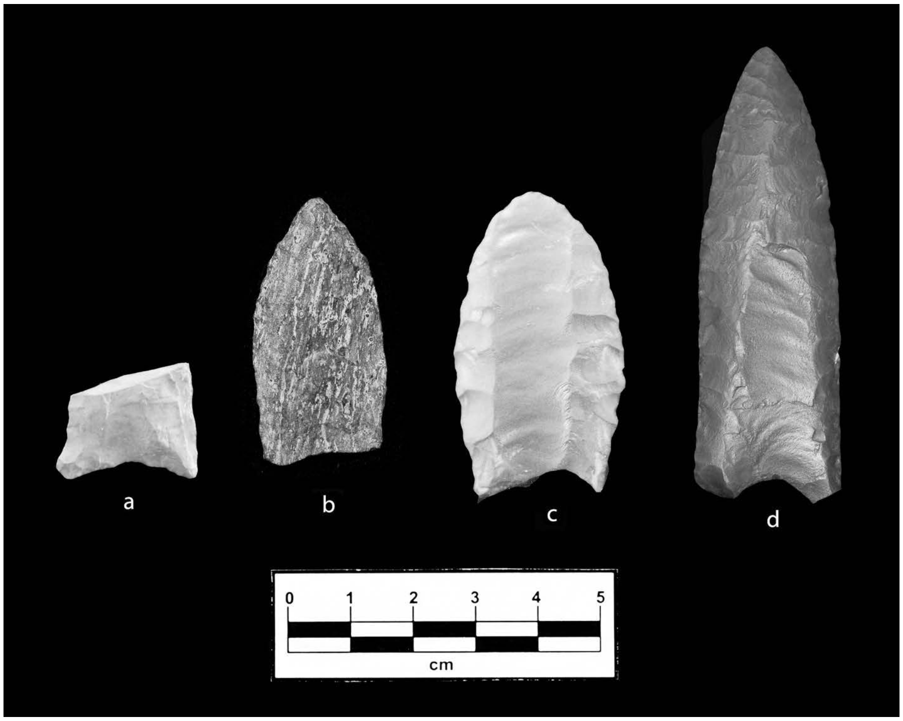
Hinsdale Site (VT-AD-195)

This site was first reported by Loring (1980:29, Figure 5) based on an inspection of a collection from the Hinsdale family farm in Ferrisburgh, which includes a fluted point made from a dark brown chert. The site is situated on the south side of Fields Hill at an elevation of approximately 79 m (260 ft) near a tributary of Little Otter Creek (figure 3.1, site 10). Based on a photograph of the artifact taken by Loring and archived at the VDHP (figure 3.8c), the point appears to have a tip that was reworked after an overshot fluting attempt. Based on the slightly flared base and full-length fluting (which likely overshot), the point most closely resembles Michaud-Neponset forms and therefore dates to circa 12,200–11,600 cal BP.

Little Otter Creek Sites (VT-AD-82/VT-AD-167)

In addition to the Early Paleoindian period Hinsdale site, two other sites within the Little Otter Creek drainage have yielded Paleoindian sites/finds. As with the Hinsdale site find, these were first reported by Loring (1980). One spot find (VT-AD-82) is located in New Haven, on the west side of a north-south trending ridge that separates the Little Otter Creek drainage on the east and the Mud Creek drainage, which is a tributary of Little Otter Creek, on the west (see figure 3.1, site 11). The point is made of red chert, most likely Munsungun chert, and is well made and complete but for missing basal ears (figure 3.8d). The find spot, at an approximate elevation of 101 m (330 ft), was identified by landowner Earle Bessette and later GPS-defined by F. Robinson. Based on the point's flaking, thinness, elongated flute scars, and concave and slightly flared base, it can be placed in the Michaud-Neponset group and thus dated to circa 12,200–11,600 cal BP.

Another fluted point find from the same area can be associated with recorded site VT-AD-167. Located



3.8. Michaud/Neponset fluted points and point fragments from Vermont attributable to the Middle Paleoindian period: a, weathered chert projectile point base from site VT-AD-679; b, rhyolite projectile point from site VT-AD-167; c, chert projectile point from VT-AD-195 (photo by Stephen Loring, courtesy of the Vermont Division for Historic Preservation); d, probable red Munsungun chert projectile point from site VT-AD-82.

approximately 555 m (1,821 ft) to the south of VT-AD-82, this area has yielded quartzite debitage in addition to a fluted point fragment from an elevation of approximately 91 m (300 ft), also collected by landowner Earl Bessette. This location was also recently mapped by F. Robinson (figure 3.1, site 12). The midsection and tip point fragment exhibits what would have been a full-length flute and appears to be slightly waisted (figure 3.8d). Thus, it too is tentatively attributable to the Michaud/Neponset point type and to a date range of 12,200–11,600 cal BP. The second Bessette point is manufactured from a dark gray rhyolite with white banding (figure 3.8b). The source of this material is not known.

These two site locations are related to bedrock ridge outcrops above and on the margins of secondary stream valleys. In each case, the sites were likely hunting camps, positioned to intercept animals along game trails or to gain lines of sight across the shallow valleys nearby.

Lake Salem Site (VT-OL-57)

The Lake Salem site is a find spot on the northeastern shoreline of Lake Salem in Orleans from which a fluted point was recovered. This location is to the south of Lake Memphremagog, the largest lake in northeastern Vermont (see figure 3.1, site 13). The small point, which is likely chert, was described as a "rich brown color" (possibly Onondaga chert from western New York). Based on its size, shape, eared base, and pronounced basal concavity, it most closely resembles Michaud/Neponset type points. The point was recovered by Emily Wheeler and Celie Dagesse from what was likely a fill deposit. Fill in the area where the point was found reportedly originated near the outlet of the Clyde River at the southern end of Lake Salem (VAI site files). The find spot and likely original location of the projectile point lies at an approximate elevation of 91 m (300 ft) amsl. The site location is significant in that it is on a potential east-west corridor between the Champlain Sea and the upper Connecticut Valley. Like sites identified by Chapdelaine at Lake Mégantic in Quebec (Chapdelaine 2007), the site location falls in an intermediate position relative to the Champlain Sea and major north-south drainages.

Site VT-AD-679

The VT-AD-679 site is located on the west side of the Lemon Fair River, upstream from the Route 74 bridge in the town of Shoreham at an approximate elevation of 49 m (160 ft) (see figure 3.1, site 14). Artifacts were noted eroding from the terrace above the west bank of the river. The

base of a fluted point was recovered within a larger concentration of artifacts by Geoff Mandel of UVM CAP while portaging a kayak (figure 3.8a). The site was first recorded as a result of collector information and a site inspection by the USDA NRCS. The artifact is made of an undetermined chert, now weathered to a pale, tannish brown color. Based on the fluting and its slightly eared base, the artifact resembles Michaud/Neponset forms, and therefore at least one occupation at what is likely a large, multicomponent site dates to the Middle Paleoindian period.

AUCLAIR SITE (VT-CH-3)

The Auclair site is a muticomponent site located in Shelburne on a knoll on the east side of Muddy Brook, just downstream from the outlet of Shelburne Pond (Petersen et al. 1984) (see figure 3.1, site 15). Muddy Brook flows northward before draining into the Winooski River. The site is situated above the stream at an approximate elevation of 104 m (340 ft). Like Bristol Pond, Shelburne Pond was larger during the late Pleistocene and early Holocene, so the site may have been closer to the pond's paleoshoreline at the time of occupation.

A fluted point base is included in the artifact collection of Ken Varney housed at the UVM Anthropology Department. Based on its morphology, the point, manufactured from an unidentified gray chert (figure 3.9, left), falls into the Crowfield-related group of projectile points and therefore dates the earliest occupation at this site to sometime near the end of the Middle Paleoindian period.

3.9. Crowfield type tools, attributable to the Middle Paleoindian period: left, chert fluted projectile point fragment from the Auclair site (VT-CH-3), Ken Varney collection; right, complete, possible Munsungun chert point from Bristol Pond (VT-AD-11), Langdon Smith collection.

BRISTOL POND SITES (VT-AD-11/VT-AD-160)

As discussed in the Early Paleoindian section, the Bristol Pond area in Bristol, Vermont, contains several multicomponent Native American sites frequented by artifact collectors but not studied systematically. Sites on the western side of Bristol Pond or Lake Winona have produced several fluted points that have been documented, one of which falls into the Middle Paleoindian period based on its morphology. The point, collected by Langdon Smith and attributed to the VT-AD-11 area and an approximate elevation of 152 m (500 ft) amsl, is exquisitely manufactured (figure 3.9, right). It is made of black and gray banded chert, the source of which is not definitively known but which resembles the Norway Bluff variety of Munsungun chert. It exhibits a slightly flared base, a moderate but well-formed basal concavity, and one recognizable unflaring basal ear (other is missing). On both faces a complex pattern of overlapping and side-by-side channel flake scars is evident. Cumulatively, the general pumpkin-seed-like shape and side-by-side fluting patterns suggest a Crowfield-related type. As with the Early Paleoindian point recovered from the other side of the lake (discussed above), the rough location of the site would have been nearer the lakeshore at the time of occupation and proximal to quartzite quarry resources.

VT-CH-230, LOCUS 3

Site VT-CH-230 is a large site identified in Essex by UVM CAP during studies undertaken in advance of the CCCH. The site included a Late Paleoindian component in addition to the remains of three Early Archaic period extractive camps. Locus 3 at VT-CH-230 was situated at the north end of a large, low bedrock ridge on the east side of Indian Brook in Essex at an elevation of approximately 146 m (480 ft) amsl (see figure 3.1, site 16). Its location provided relatively good drainage compared to the wet areas that likely bordered the brook. Depending on the woodland

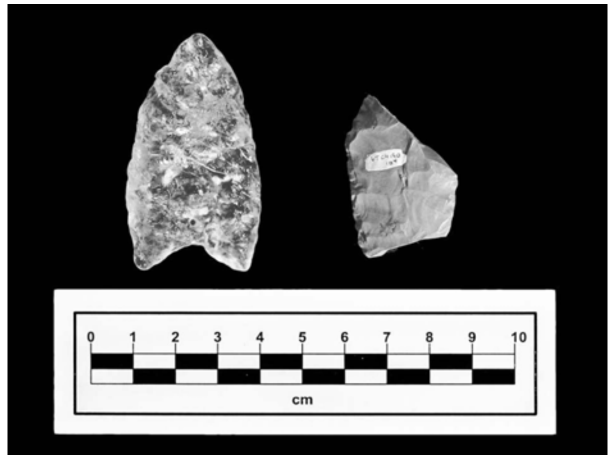
vegetation, the ridge may have also provided some sight advantage for big-game hunting. Roughly 30 percent of the site was excavated before it was destroyed by highway construction.

The entire artifact assemblage consists of a projectile point base; the tip of a second point; four flake tools that were used to scrape, shave, and process a soft substance, perhaps sinew; 146 chert flakes produced when several tools were made; and one piece of burned bone. Twelve quartz flakes are most likely related to a later Early Archaic occupation. The projectile point base is narrow and contracting and resembles those of the Cormier/Nicholas group of points. As a result, the tool fragment and related occupation are attributable to the Middle Paleoindian period. The locus of the site where the point base was found covered a maximum area of 80 m^2 (860 ft^2), with most artifacts concentrated in an even smaller area.

The site lies adjacent to the Indian Brook drainage, a tributary of the Winooski River. In addition to concentrating plant and animal resources, at the time of occupation this small stream likely served as a travel corridor between the retreating Champlain Sea and upland areas. Two types of chert are present both as debitage and as finished tools, roughly in equal proportions. Black chert at the site likely was obtained locally from the Champlain Valley. The second type is very similar to lustrous, gray-green chert derived from quarries of the Normanskill Formation in the central Hudson River Valley. Other loci at the Indian Brook site are attributable to the Early Archaic period, showing continuity of use of this portion of the secondary stream corridor.

PAQUETTE 2 SITE (VT-CH-190)

The Paquette 2 site is located in Colchester on an outwash terrace between two unnamed tributaries of the Mallets Bay portion of Lake Champlain (see figure 3.1, site 17). The site lies at an approximate elevation of 61 m (200 ft). A midsection of a projectile point was recovered by UVM CAP during the CCCH project during a surface collection of a plowed field. Based on its pentagonal shape and contraction of its lateral margins toward the base, the point fragment resembles several projectile point fragments in the Reagen site collection. This tool may have been broken during an attempt to flute it or may have been a nonfluted form broken during the final stages of production (figure 3.10, right). Based on the point's form, this site can be assigned to the Cormier/Nicholas group of Middle Paleoindian period projectile points and, therefore, the occupation at Paquette 2 is likely to have occurred sometime circa 12,200–11,600 cal BP.



3.10. Cormier/Nicholas tools, attributable to the Middle Paleoindian period: left, crystal quartz projectile point from South Hero (photo courtesy William Haviland); right, chert projectile point fragment from the Paquette 2 site (VT-CH-190).

SOUTH HERO CRYSTAL QUARTZ POINT

A collector recovered a crystal quartz fluted point from a location on South Hero Island (see figure 3.1, site 18) in Grand Isle County in the 1930s. A sketch of the artifact was first published by Haviland (1969). Loring (1980) also references the artifact, and Haviland and Power later published a photograph of the find (1994:29).The point was reportedly recovered from recently deposited fill. It is relatively small with a wide midsection (figure 3.10, left) and may be weakly fluted with a relatively deep basal concavity, similar to Cormier/Nicholas forms attributable to the Middle Paleoindian period.

The uncertain provenience of the point makes it difficult to speculate about its original context. Assuming, however, that the fill likely came from somewhere on South Hero or in Grand Isle County, the point may represent a site that once was located on an island or peninsula in the Champlain Sea. South Hero happens to have the highest elevation of these islands, with hills that exceed 76 m (250 ft) and numerous sand and gravel quarries where the projectile

point may have originated. Although the vast majority of land that now includes the Champlain Islands was likely submerged for the majority of the Champlain Sea episode, some of the higher elevations likely were exposed sometime prior to the transition from ocean to lake. These emerging islands would likely have included points on South Hero and the southern end of Isle la Motte, which may have attracted settlement or resource procurement forays during the Middle and Late Paleoindian periods. Therefore, if the crystal quartz point did originate somewhere in the vicinity of these islands, it may have come from what was once a low-lying beach, or it could be an overboard loss. We will likely never know. Nonetheless, the possible attribution of the point to the islands portion of the Champlain Valley presents interesting questions about Paleoindian use of the Champlain Sea and the islands and shallows within it.

Late Paleoindian Period, circa 11,600–10,800 cal BP

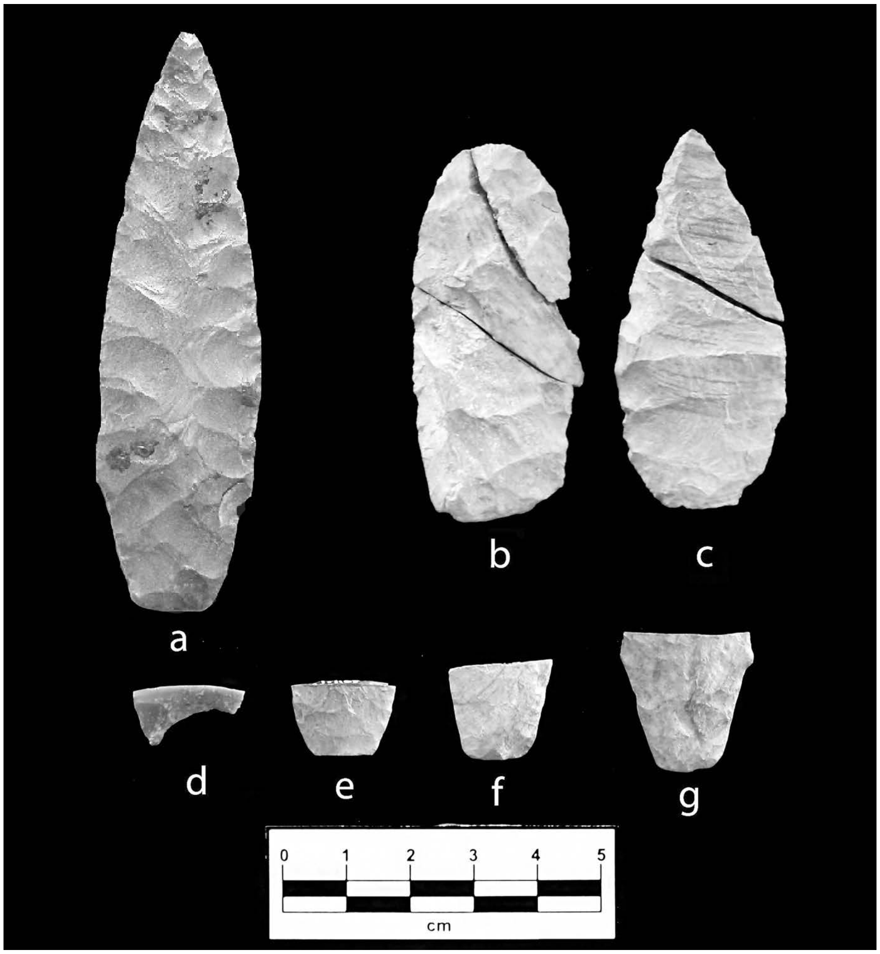
MAZZA SITE (VT-CH-9179)

The Mazza site is located in Colchester on a level, sandy outwash terrace at an elevation of approximately 49 m (160 ft) amsl, between an unnamed tributary of Sunderland Brook to the east and Sunderland Brook immediately to the south (see figure 3.1, site 19). Sunderland Brook flows into the Winooski River, which in turn flows directly into the Malletts Bay portion of Lake Champlain. The site was first identified by UVM CAP in 1984 during a surface survey conducted for the CCCH project. Ten artifacts were recovered during the initial identification of the site, including a sidescraper fragment made of a nonlocal chert and a modified flake with two graver "spurs" (Dillon et al. 1986). The exotic material and presence of the spurred tool provided early but inconclusive evidence of a Paleoindian occupation (Thomas et al. 1985). In 2002 a redesign of a proposed highway interchange expanded impacts to include the edge of the terrace above the Sunderland Brook tributary.

Testing in an area roughly 40 m (131 ft) west of where artifacts previously had been surface-collected revealed another, more significant locus of the site. Over the three phases of archaeological investigation in this portion of the site, test pit (0.5 by 0.5 m) and test unit (1.0 by 1.0 m) block excavation included a combined total of 86.5 m^2 (283.7 ft^2), or approximately 50 percent of the small site/site locus. The cumulative excavations resulted in the recovery of 751 total artifacts, of which 67 (8.9 percent) were lithic tools or tool fragments. Laboratory refits resulted in a total of 58 articulated tools or tool fragments. The remaining artifacts (91.1 percent) include lithic debitage of various materials (Robinson and Crock 2006). Among the tools recovered are three projectile point bases that are definitively Late Paleoindian in age based on their morphology and flaking pattern (figure 3.11e–g). The three bases and one other possible base (figure 3.11d) all exhibit the basal portion of lanceolate forms, gracile cross sections, basal grinding, and a transverse parallel or parallel oblique flaking pattern. Based on these characteristics, the point fragments are attributed to the Ste. Anne/Varney group, dating the site to the Late Paleoindian period. Identical flaking patterns also are exhibited by two bifaces made from elongated flakes, which may represent short projectile point preforms or completed knives (figure 3.11b–c).

The most complete of the projectile point bases exhibits a stem that contracts from the point below two subtle and shallow shoulders. The distal end terminates in a transverse break just above the shoulders where the blade margins begin to angle toward the tip. The proximal end is squared or flat relative to the lateral stem margins. The "stem" portion of the base is heavily ground, partially obscuring but not obliterating the flaking pattern across both surfaces of the stem and along the lateral margins. Evidence of grinding ceases, however, at the shoulders, where two consecutive sharpening flake scars are present on one shoulder edge.

One of the most striking aspects of the artifact assemblage from the Mazza site is that the majority of recovered artifacts (n = 443; 59.0 percent) are Mount Jasper rhyolite, likely originating from quarries in Berlin or Jefferson, New Hampshire (Pollock et al. 2008). The high proportion of exotic material in this assemblage implies either recent travel over the Green Mountains and White Mountains by the site occupants or a recent exchange with individuals who transported the material to the Champlain Valley. After the exotic rhyolite, the next most common type (n = 140; 18.6 percent) is an aggregate category of various nonlocal cherts. This material designation primarily includes cherts macroscopically likely attributable to sources in the Hudson Valley in New York, although several pieces of lithic debitage resemble chert from the Onondaga Formation in western New York or Ontario. Additionally, some flakes appear



3.11. Ste. Anne/Varney tools, attributable to the Late Paleoindian period: a, chert projectile point from the Gonyeau collection; b–c, Mount Jasper/Jefferson rhyolite bifaces; d–g, projectile point bases from the Mazza site.

to be a fine-grained gray to tan chert with translucent inclusions. These inclusions may instead signal that the material is a rhyolite or felsite, though it is macroscopically dissimilar to Mount Jasper rhyolite or Mount Kineo felsite from Maine. Its source remains unknown. In addition to an apparent absence of Kineo felsite, no recovered artifacts appear to be made of Munsungun chert. Lesser amounts of other materials also are represented, including local Champlain Valley unidentified gray chert (*n* = 78; 10.4 percent), quartzite (*n* = 29; 3.9 percent), quartz (*n* = 11; 1.5 percent), local Champlain Valley chert (*n* = 5; 0.7 percent), shale (*n* = 1; 0.1 percent), sedimentary stone (*n* = 1; 0.1 percent), and untyped felsite (*n* = 5; 0.7 percent), one flake of which closely resembles a material informally referred to as Mount Ascutney felsite. The remaining artifacts (*n* = 38; 5 percent) are classed as untyped materials, which collectively include several coarse materials possibly collected near the site area.

We analyzed all artifacts macroscopically for material type with the aid of comparative lithic collections. Additionally, colleagues independently corroborated several material type attributions, particularly the Mount Jasper rhyolite examples (e.g., R. Boisvert, personal communication, 2003). Nevertheless, though we are fairly confident in the categorization of material types, they must remain tentative in lieu of chemical, elemental, or other fine-grained analysis.

After the excavation of the Mazza site had concluded, UVM CAP fortuitously examined a Late Paleoindian lanceolate projectile point from the collection of Richard Gonyeau (Robinson and Crock 2006). This point, likely made of Munsungun chert, exhibits the same stem-to-shoulder-to-blade morphology as the previously described base from the Mazza site (figure 3.11a). The projectile point was surface-collected by Mr. Gonyeau's father, likely on his fields near the Colchester/Milton border, where Richard Gonyeau still lives. These fields are relatively close to the

Mazza site (ca. 8.9 km as the crow flies) and are located on a similar sandy landform. The fields from which the point was collected also have yielded evidence of multiple occupations throughout prehistory, collected by avocationals and recovered in the context of professional studies. Collectively, these sites are designated VT-CH-54, VT-CH-21, and VT-CH-101 in the VAI. Another probable early site, the Arbor Gardens site, discussed below, is located just across U.S. Rte. 7 from the fields Mr. Gonyeau's father collected (Toney and Crock 2006).

The projectile point base from the Mazza site and the point from the Gonyeau collection clearly represent Late Paleoindian projectile point forms. We are unaware of any points with a similar stem-to-shoulder-to-blade morphology from other sites in the near region (Robinson and Crock 2006). Because Mazza is the first systematically excavated Late Paleoindian site with diagnostic tools in Vermont, this is not surprising, at least on a local level. Additionally, though gracile and finely flaked lanceolate points still are the prominent hallmark of Late Paleoindian period components in more easterly portions of the Northeast, several blade and base forms with no apparent western analogue are evident in regional archaeological sites, including points with acute isosceles triangular blades and prominently notched and stemmed bases (e.g., Chapdelaine 1994; Dumais 2000; Petersen et al. 2000; Storck 2002; Thomas 1992; Thomas et al. 1996; Wright 1995). These regional forms may even be present within the same site as lanceolate points with morphologies similar to point styles to the west (Chapdelaine 1994; Petersen et al. 2000, 2002; Storck 2002). Intrasite variability in terms of basal morphology also appears to pertain at the Mazza site.

In summary, judging by the spatial distribution of artifacts and tools, refit debitage and tool fragments, heat-altered lithic material, and artifact densities, it seems likely that the Mazza site represents a single-family occupation or a locus of a larger settlement. With regard to the latter possibility, there may be other potentially related artifact concentrations or loci in the area, as indicated by the unifacial tool recovered farther into the center of the landform and a continuation of low lithic debitage counts identified north of our contiguous block excavation at the northern end of the site. Unfortunately, these areas were outside the area of potential project impact and thus could not be explored. It is difficult to infer a season of use for this site, given the poor preservation within acidic soils, deep plow disturbance, and great antiquity of the occupation. However, the tabular knife recovered from the site, possibly used for fish processing, may give some indication that the site was occupied during the warmer months (Robinson and Crock 2006).

ARBOR GARDENS SITE (VT-CH-885)

The Arbor Gardens site is located in Colchester and situated at an elevation of approximately 61 m amsl (200 ft) on an elevated sandy terrace formed by the Champlain Sea (see figure 3.1, site 20). The site was identified by UVM CAP in the course of studies conducted in advance of a housing development. Important waterways near the Arbor Gardens site include Allen Brook, a tributary of Mallets Creek, which drains into the Mallets Bay portion of Lake Champlain, and the Lamoille River. Based on the results of three phases of fieldwork, the Arbor Gardens site is spread across an area of over 2,200 m^2 (23,681 ft^2) and includes at least two discernable activity areas and possibly four. Most of the larger block excavation conducted at the site was completed within Activity Area 1, where the densest deposits of artifacts were encountered. Notably, Activity Area 1 is in the central portion of the landform, well away from the terrace edges overlooking Allen Brook and its tributaries. The phase 3 data recovery consisted of the block excavation of fifty-nine 1.0 by 1.0 m excavation units, or roughly 60 percent of the approximately 98 m^2 (1,055 ft^2) Activity Area 1.

A total of 31 flaked stone tools were recovered from the three phases of excavation at the Arbor Gardens site. This total includes 34 tool fragments, several of which conjoin to form an articulated, single tool. The tool inventory includes one projectile point fragment, six bifacially flaked tools, five bifacially flaked tool fragments, four unifacially flaked tools, and 15 utilized flakes. A variety of local and exotic lithic materials are represented within this assemblage, including a single projectile point base made from gray-black chert likely originating from the Onondaga Formation in western New York or possibly another locale outside of Vermont. The tool is broken at its basal inflection, making the analysis of the flaking and overall shape of the original tool difficult to assess. Despite the fragmentary

nature of the artifact, it is morphologically comparable to diagnostic lithic materials from the broader Northeast that date to the Paleoindian and Archaic periods. In southeastern Quebec, the La Martre and Mitis Late Paleoindian sites contain elongated Ste. Anne/Varney-like points of a similar dark brown chert, exhibiting expanding bases with similar basal thinning (Dumais 2000:89). The Late Paleoindian Rimouski site in Quebec also produced points with bases similar to the one found at the Arbor Gardens site (Chapdelaine 1994:181).

Additionally, the Varney Farm site in western Maine produced several projectile point specimens with bases similar to the fragment recovered from Arbor Gardens (Petersen et al. 2000). The tool inventory from the Arbor Gardens site also includes 12 bifacially flaked stone tools/tool fragments, some of which articulate to form 10 separate tools. These 10 tools/fragments are made from a variety of local and exotic lithic raw materials, including a weathered Mount Jasper/Jefferson rhyolite, unidentified gray Champlain Valley chert, and local gray "Cheshire" quartzite. Of note, one tabular biface manufactured from Mount Jasper/Jefferson rhyolite was recovered. Although both edges are worked, only one edge of this tabular tool exhibits use wear, perhaps as a sidescraper. Elsewhere we argue that tabular knives such as this are diagnostic of Late Paleoindian and Early Archaic assemblages and may have been used to process fish or marine mammals (Robinson and Crock 2006). For example, a similar biface was recovered from the Weirs Beach site in New Hampshire with an associated radiocarbon date of 9615 ± 25 BP and is "considered to have a Plano technological affiliation" (Bolian 1980:124). Other analogues for this biface include large tool fragments recovered from the Late Paleoindian Rimouski site in eastern Quebec (Chapdelaine 1994:191).

A total of 15 utilized but not intentionally modified flakes were recovered as well, found in distinct material-type clusters. Cutting and scraping activities appear to have been conducted in discrete areas by individuals each using a different raw material. One cluster comprises five utilized flakes all made from a weathered greenish rhyolite, likely Mount Kineo rhyolite, from a source near Moosehead Lake in central Maine. A second cluster of four black chert flakes was recovered from the southern portion block, with one additional black chert flake recovered from the Activity Area 2. A third cluster of utilized flakes was found in the central portion of the phase 3 excavation block and comprises three quartzite tools. Finally, a single utilized flake made from Mount Jasper/Jefferson rhyolite also was recovered.

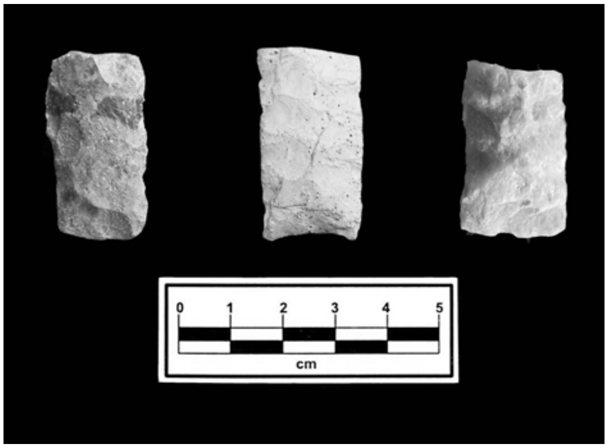
A total of 3,401 pieces of lithic debitage were recovered during all three phases of excavation at the Arbor Gardens site. Almost 25 percent of the total lithic debitage is exotic to Vermont; the remaining 75 percent is likely from local sources, though some of the black chert recovered may be exotic as well. Of the total, 64 percent of the debitage is Champlain Valley black chert; 17.8 percent is Mount Jasper/Jefferson rhyolite from New Hampshire; 10.2 percent is local Cheshire quartzite; 7.0 percent is Mount Kineo felsite from the Moosehead Lake region of Maine; and 1.0 percent is quartz, probably of local origin.

The small mean size of the debitage recovered (<1 cm, 80.7 percent) indicates late-stage lithic reduction (1–2 cm, 0.8 percent; >3 cm, 0.5 percent). This extraordinary number of small, likely tertiary reduction flakes suggests that the main activities taking place at the site were late-stage lithic reduction.

The Gonyeau collection point discussed above was reportedly recovered less than a kilometer northwest of the Arbor Gardens site in Milton from fields that also have yielded evidence of multiple Native American occupations up through the Woodland period both in collections by avocational investigators and through professional CRM projects.

ARNOLD BROOK SITE (VT-RU-572)

The Arnold Brook site is located immediately adjacent to Arnold Brook in Brandon, Rutland County, and was identified during archaeological studies conducted by UVM CAP for a transmission line project (F. Robinson et al. 2009). The site lies on a low, level, wooded terrace at approximately 137 m (450 ft) amsl within a broad valley landform that is slightly elevated above the expansive Brandon Swamp to the west (see figure 3.1, site 21). The land rises significantly to the north to the crest of a large hill. Another large wetland lies approximately 145 m northeast of the site. In total, 39.25 m^2 was excavated during the cumulative phased excavations within the core portion of the site (F. Robinson et al. 2009). These excavations re-



3.12. Ste. Anne/Varney projectile point fragments attributable to the Middle Paleoindian period: left, chert base and midsection from the Arnold Brook site (VT-RU-572); middle, Kineo rhyolite base and midsection from Bristol Pond (VT-AD-11), Langdon Smith collection; right, quartzite base and midsection recovered from the Winooski Redevelopment site (VT-CH-990).

sulted in the recovery of 1,034 total Native American cultural artifacts. The vast majority of the recovered artifacts are lithic debitage (*n* = 903) that represents the remains of stone tool manufacture. A total of 41 lithic tools were also recovered from the cumulative excavations conducted at the site, including five biface fragments, one chopper, two core tools, one probable drill fragment, one hammerstone, one modified flake, two fragmentary projectile points, 22 unifacial tools of various kinds, and six utilized flakes and flake fragments. A total of 79 fire-cracked rock fragments and 11 raw material nodules were also recovered. One of the projectile point fragments, a basal portion, is temporally diagnostic (figure 3.12, left). Based on its elongated lanceolate morphology, presumed small width-to-length ratio, diamond-shaped cross section, and basal grinding, among other factors, the projectile point appears to be typologically diagnostic of the Ste. Anne/Varney group of Late Paleoindian period projectile points. Accordingly, this site is one of only a handful of sites attributable to the Late Paleoindian period in Vermont, particularly in the southern portion of the Champlain Basin, and may represent the first special-purpose, extractive site of this period identified in the state.

The lithic artifact assemblage recovered from the Arnold Brook site indicates activities related to stone tool manufacture and maintenance, as evidenced by the lithic debitage and several biface fragments. Hunting activities are also represented by the lanceolate point base and another nondiagnostic projectile point tip. Beyond these activities, however, the tool assemblage is remarkably homogenous and is characterized by the large number of unifacial tools, most of which are minimally reduced and quite coarse. Although the precise functions of these tools are currently unknown and their working edges vary somewhat in formation, angle, and evidence of use, among other factors, their generally robust and coarse nature suggests that they would have been best suited for processing a hard substance. Likewise, the large size of some of these tools and their relative abundance at the site suggest that this processing activity was fairly intensive. Because of these factors and the site's location within a biotically productive wetland/stream setting, it is suggested that wood acquisition and processing were the primary activities undertaken there.

Interestingly, tentative analogues for this type of site have been identified for the subsequent Early Archaic period in Vermont. Recent palynological studies suggest that, rather than the barren tundra or sparsely forested spruce parkland once proposed for this area, the site was occupied during a time when forests were characterized by an abundance of pine (*Pinus*), significant percentages of spruce (*Picea*), and evidence of hemlock (*Tsuga*), fir (*Abies*), birch (*Betula*), and oak (*Quercus*) (Anderson 1988; Anderson et al. 2007; Cronin et al. 2008). Of course, the developing wetland settings within Brandon Swamp, along the Otter Creek, and within the localized area of Arnold Brook may have been a powerful attraction to Native American groups within the area (Nicholas 1987, 1988) and may have been areas that fostered the growth of newly resident deciduous tree species.

Although the Otter Creek 2 site, less than 2.5 km (1.55 mi) to the northwest, and the Winooski Redevelopment site (both discussed below) are arguably more tied to the resources and transportation corridor along the main stems of major rivers, the location and assemblage at the Arnold Brook site speaks to the potential abundance and exploitation of plant resources along secondary streams during the Late Paleoindian period.

OTTER CREEK 2 (VT-RU-13)

The Otter Creek 2 site is located on a low rise/knoll on the east side of Otter Creek in Brandon Swamp at an elevation

of roughly 116 m (380 ft) (see figure 3.1, site 22). Extensive private collections have been made here (VAI site files), and limited systematic work was conducted at the site by Ritchie (1979). Although the site is better known for its extensive Late Archaic, Laurentian tradition occupation, Ritchie recovered several projectile points representing earlier occupations within his designated Zone 3 horizon at the site (which also yielded Late Archaic tools). Among these are three "fragmentary points or knives of possible Plano style" (1979:6). Ritchie cites the "collateral or parallel ribbon flaking technique" (1979:6) as diagnostic, differentiating these tools from the other projectile points recovered. Based on the flaking illustrated (1979:Plate 2, 7–9) and described, these points can likely be assigned to the Ste-Anne/Varney group. Of interest, the site also may have had an earlier, Early Paleoindian occupation, as suggested by a probable fluted point in the Sandy Fellon collection from the site (artifact VT-RU-13:300, illustrated by Loring, in VAI site files). The long-term use of this particular swamp island, beginning as early as the Late Paleoindian period and perhaps earlier, testifies to the long-term productivity of the Brandon Swamp portion of the Otter Creek drainage as well as the early importance of the limited, well-drained landforms available for habitation. Though it is unclear where the Otter Creek channel was located in relation to the site during its earliest occupation, the site demonstrates the presence of people along the main stem of a major river between the sea/lake and the western foothills of the Green Mountains.

WINOOSKI REDEVELOPMENT SITE (VT-CH-900)

The Winooski Falls site is a multicomponent site located on the north side of the Winooski River, just above the falls in Winooski, Chittenden County, at an elevation of approximately 51 m (168 ft) amsl (see figure 3.1, site 23). The site was identified as part of a regulatory study undertaken in 2002 for the Winooski Redevelopment project by the Archaeology Consulting Team (Frink 2002).

A parallel-flaked, basally thinned quartzite projectile point base and midsection was recovered from 46–59 cm below the ground surface within a buried historic plow zone that also contained historic artifacts (figure 3.12, right). The artifact is not waterworn and does not exhibit any other characteristics that would suggest it was redeposited by fluvial or other processes; therefore, the site location is considered accurate. Moreover, despite its position adjacent to the Winooski River, a cursory examination of the specific site locale suggests that it was not regularly subject to flooding until the recent historic past when the river was narrowed at that point and a dam was constructed. Thus, the point's intermixture with more recent artifacts is not altogether anomalous. Based on the projectile point's narrow blade, flaking, and basal treatment, it is related to Ste. Anne/Varney type tools and is therefore attributable to the Late Paleoindian period. The location of the site near the modern channel of the Winooski River indicates that by Late Paleoindian times habitable landforms existed along lower elevations of major river valleys in locations that would have been inundated by the Champlain Sea in previous Paleoindian subperiods.

BRISTOL POND SITES (VT-AD-11/VT-AD-160)

As discussed in the Early and Middle Paleoindian sections, the Bristol Pond area contains several multicomponent Native American sites frequented by artifact collectors. In addition to producing fluted points attributable to earlier Paleoindian periods, an area on the western side of Bristol Pond or Lake Winona at or in the vicinity of site VT-AD-11 also has yielded at least one tool that can be attributed to the Late Paleoindian period. A square-based, parallel-sided, and parallel-flaked projectile point fragment made of weathered Kineo felsite was collected by Langdon Smith (figure 3.12, middle). Though Mount Kineo rhyolite does appear at the Reagen site in a form attributable to a slightly earlier Paleoindian subperiod (Cormier/Nicholas), the use of this material is more clearly associated with Late Paleoindian occupations in some portions of the Northeast such as at Lake Mégantic (Chapdelaine 2007). This point helps round out what appears to have been a repeated occupation of the Bristol Pond/Lake Winona area throughout Paleoindian times. This body of water offered a concentration of natural resources and close proximity to quartzite sources, in addition to proximity to upland valley corridors through the Green Mountains, leading to its margins being occupied and reoccupied during Paleoindian times and, later on, throughout the entire precontact era.

Bessette II Site (VT-FR-140)

The Bessette II site is located in Highgate, along a secondary terrace of the Missisquoi River at an approximate elevation of 61 m (200 ft) (see figure 3.1, site 24). Bessette II is the uppermost and earliest occupation within a multicomponent, horizontally stratified site complex (Thomas et al. 1996). The site is included here as an example of a late Late Paleoindian period occupation, or one transitional with the Early Archaic period, on the basis of projectile point forms, an associated tool suite, and a radiocarbon date. The two projectile point fragments from the site both exhibit gracile, side-notched bases with more or less parallel-flaked, lanceolate midsections. Both appear to be made from nonlocal cherts, macroscopically similar to material derived from quarries in the Hudson Valley. The parallel-sided, parallel-flaked blades and shallow notching on two of the bases seem to combine characteristics of Ste. Anne/Varney Late Paleoindian forms with notched Early Archaic forms (Bradley et al. 2008). Moreover, barring the projectile point forms, the other artifacts are much more characteristic of regional Early Archaic occupations, with large tabular knives made of sedimentary stone and a suite of quartz tools (Thomas et al. 1992; see Robinson and Crock 2006).

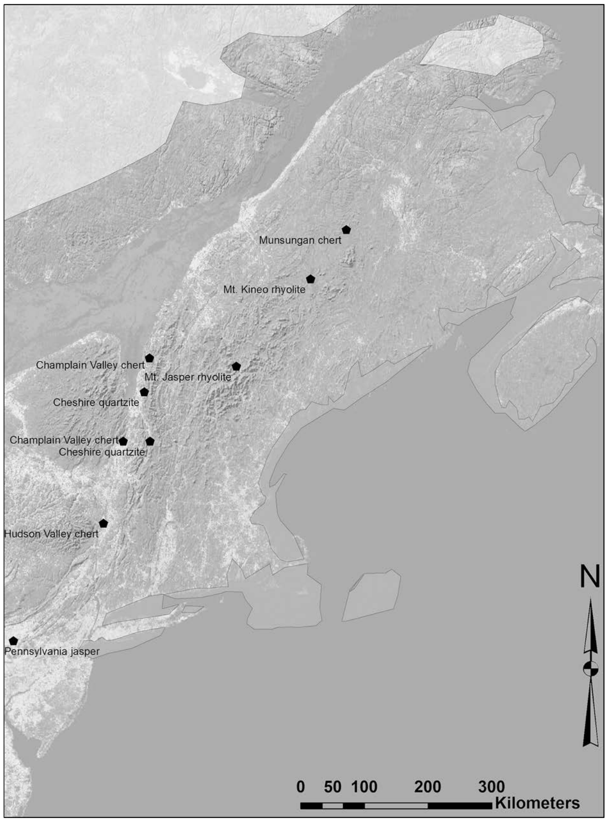
A radiocarbon date of 7730 ± 180 BP (Beta-8503) was returned from a buried wood fragment above the area of the projectile points' recovery (Thomas et al. 1996). When calibrated, the two sigma range for the date is between 9008 and 8187 BP, or right at the generally accepted chronological position between the Late Paleoindian and Early Archaic periods, though how much earlier the site dates is uncertain and the wide two sigma range is not helpful. As reported by Bradley and others (2008), Ste. Anne/Varney style points have been recovered from sites dated to even more recent periods, including the Rimouski site (Chapdelaine 1994) and the Lower Saranac River site (Hartgen Archaeological Associates 1991), which is situated in a similar setting across the lake. Thus, the end date for Ste. Anne/Varney occupations is far from clear at this point, and it may have varied locally. Bessette II is therefore important as potentially representing a transitional component between the two. Certainly sites such as Bessette II and the John's Bridge site (Thomas 1992; Thomas and Robinson 1980) attest that the Missisquoi River and other major river corridors likely developed into even more important resource zones during the Early Archaic period.

DISCUSSION

Recent advances in our understanding of Paleoindian settlement in what is now Vermont can mainly be attributed to the cumulative results of regulatory archaeology over the past decade. Though the information gained from accumulating spot finds remains invaluable to our reconstructions of early human history in Far Northeast, there is no substitute for sites systematically studied in their primary context. When the range of site settings can be evaluated alongside associated artifact assemblages, the results are particularly revealing for the reconstruction of both the timing and direction of human entry into what is now Vermont and subsequent trends in settlement and site function. Issues regarding the directionality of both settlement and interregional communication can be made on the basis of exotic lithic materials represented in finished projectile points attributable to Paleoindian periods and the proportions of exotic materials recovered from systematically studied Paleoindian sites (figure 3.13). These data indicate that, from the outset, Paleoindians in Vermont were linked geographically and socially to groups to the east and the west. Based on a high incidence of exotic materials originating in Maine and New Hampshire, however, Vermont Paleoindians appear to have been closely connected to points east throughout the Paleoindian periods.

Early Paleoindians on the West Coast of New England

The presence of chert originating from Munsungun Lake in Maine in Early Paleoindian sites in Vermont supports a possible east-to-west colonization model. Paleoindians possibly followed the Champlain Sea outlet inland, up what later became the St. Lawrence Valley and into the inland portion of the sea. A "coastal" model of migration also is supported by the majority of sites and tools attributable to the Early Paleoindian period that have been found, not only near the margins of the Champlain Sea, but also in the northern portion of the valley, closest to the outlet. Having stated this, we do not wish to accentuate initial colonization or pioneer models, where the information is



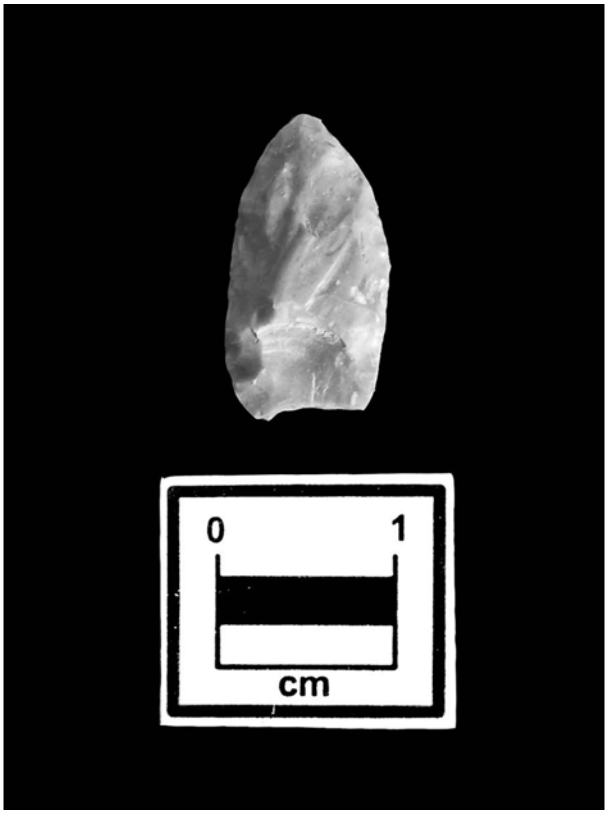
3.13. Map of the Far Northeast showing sources of lithic raw materials that appear in Vermont Paleoindian assemblages. Note estimated landscape features including the Champlain Sea at its maximum, the paleoshoreline along the eastern seaboard, and glaciated areas to the north.

necessarily impressionistic and the "first sites" will likely never be identified, or accurately identified as such. Without question, however, the Mahan site is clearly associated with the margins of the Champlain Sea, and the Reynolds and Bishop spot finds nearby also are associated with sandy, higher-elevation features on the margins of the sea, near the then mouth of the Winooski River in the northern part of Vermont (see figure 3.1 and location of Bull Brook/West Athens Hill–related sites). Of note, the mean elevation of the six Early Paleoindian sites/finds summarized above is 144 m (472 ft) amsl, well above the rough estimate of the Champlain Sea maximum (ca. 100 m [330 ft] amsl).

The range of materials represented at the Mahan site and by the Bull Brook/West Athens Hill type finds as a group, notably Mount Jasper/Jefferson rhyolite in the form of the Bishop site point and the presence of what appears to be Munsungun chert at the Mahan site, speaks to a close relationship with people and places to the east. In particular, routes to or from Munsungun Lake may have been most efficient via the Champlain Sea outlet or via an overland route through the Green Mountains and into the Connecticut Valley, then through the White Mountains, past Mount Jasper, and into the upper Androscoggin drainage. Though other materials at Mahan such as probable Pennsylvania jasper, Hudson Valley chert, and Onondaga chert also indicate a broad sphere of interaction and travel that includes the areas to the west and south of the Champlain Sea, there seems to be a stronger connection with the east, at least as emerging from the raw material proportions within the presently available data set.

From the outset, there appears to have been a familiarity with local material sources as well. Access to these materials would have been relatively easy, with cherts potentially available in exposures near the sea, or in ledges or cobbles exposed elsewhere in the valley, although Hathaway Formation cherts would not have been available until at least the latter portion of the Late Paleoindian period (Robinson 2008, 2009). Cheshire quartzite such as that used to manufacture the fluted point and preforms at the Mahan site would have been easily acquired as well, from glacially distributed boulders or in quarries on the western flanks of the Green Mountains in the Bristol/Monkton area. Vermont quartzite also has been found in Paleoindian contexts outside of Vermont, notably in the form of fluted points at the Whipple site in New Hampshire (Curran 1984) and scrapers at Paleoindian sites in Maine (Spiess et al. 1998). It is particularly interesting that some of the fluted point spot finds attributable to the Early Paleoindian period, such as those from the Leicester Flats site, are located near the headwaters of the Otter Creek drainage, which not only provides a general corridor between the sea and upland areas including postglacial Lake Dunmore but also includes areas noted for quartzite exposures. The fluted point found in the Mad River valley also indicates that the Champlain Sea-to-uplands route may have continued through the Green Mountains, perhaps via the upper New Haven River through the Appalachian Gap, which connects the Otter Creek drainage with the Mad River valley (modern VT Rte. 17).

As noted in our introduction, there is a general lack of recorded Paleoindian sites on the Vermont side of the upper



3.14. "Miniature" chert fluted point from Newbury (VT-OR-89).

Connecticut River valley, a major corridor on the east side of what is now Vermont. This lack of data is attributed to a lack of systematic sampling and collector information. One exception is a "miniature" fluted point recovered by UVM CAP during a waterline survey along Rte. 5 in Newbury, Vermont (see figure 3.1, site 25). The small point from site VT-OR-89, Locus 1, is only 1.6 cm long but exhibits fluting on both sides (figure 3.14).

Though this point was recovered from a disturbed fill context, the general location of the site, on a high terrace overlooking the valley, fits as a likely setting for a Paleoindian era occupation. Based on miniature fluted point analogues from other Paleoindian sites in the Northeast—such as recovered at Fisher (Storck 1991) and Parkhill in Ontario (Ellis and Deller 2000), Debert in Nova Scotia (MacDonald 1968), Vail in Maine (Gramly 1982), and Bull Brook in Massachusetts (Grimes 1979)—the point is likely attributable to the Early or Middle Paleoindian period. No other discernibly Paleoindian materials were recovered in association with the point, and its original provenience is unknown.

Middle Paleoindian Period Maritime Mountaineers and East-West Corridors

We have even stronger evidence of people living near the Champlain Sea by the Middle Paleoindian period, with the Reagen and Fairfax Sandblows sites situated at the outlets of two of Vermont's largest rivers, the Missisquoi and the Lamoille, respectively. The recent research on the Reagen collection by Robinson (2009) also indicates that Reagen may have had the added attraction of being at or near a chert exposure. The clear maritime focus evidenced by the location of these sites, and some tools included in the Reagen collection (Robinson et al. 2004), is coupled with evidence that people not only traveled overland though mountain passes but also spent at least some time in the higher elevations. The Jackson-Gore site in Ludlow in the heart of the Green Mountains is the most upland Paleoindian site in Vermont and, along with the Israel River complex in the White Mountains of New Hampshire (Boisvert 1998, 1999), one of only a few in such settings known regionally. The spot finds near Little Otter Creek and Bristol Pond show that, during the final centuries of the Champlain Sea, east-west routes through the Green Mountains, apparently pioneered during the Early Paleoindian period, still pertained. It is certainly worth considering what snow and ice coverage was like at higher elevations during this time and whether temperatures were cool enough to maintain snow pack year round or if peaks and higher elevation valleys were seasonally free of snow and ice. In either case, it is probable that the majority of travel through the Green Mountains to the Connecticut River valley during Early and Middle Paleoindian times occurred during the warmer months of the year. Hunting animals like caribou or moose (or less likely mammoth) in the uplands would have been easier in deep snow, but human travel would have been more difficult.

Interestingly, annual settlement cycles at this time may have run counter to reconstructions for later prehistory. Instead of a settlement pattern where people focused on lakeside and lower valley locales during the spring and summer and moved into upland hunting grounds in the fall and winter, during the Early and Middle Paleoindian periods cooler temperatures brought on by the Younger Dryas may have inverted this pattern. Instead, because of the warmer temperatures associated with the Champlain Sea environ-

ment, people may have been drawn to the coastline year round and ventured into the uplands only during the summer months when conditions were more favorable for overland travel. Unfortunately, the site sample is very small, not to mention a total lack of seasonality data in the form of floral or faunal remains. Based on the available site sample, however, nonnavigable stream corridors, arguably more difficult to follow in deep snow, appear to have been equally or more important than major valleys for travel away from the sea shore and into (and through) upland areas.

The Little Otter Creek and Hinsdale site finds, like those known from the Otter Creek drainage later, indicate movement inland from the sea for hunting, as implied by the projectile points recovered. Interestingly, the two fluted points from Little Otter Creek were found near north-south trending ridges. Not only would these ridge lines have formed natural corridors for game and overland travel by people, they also were slightly higher than surrounding terrain and therefore were likely drier as well. Other sites including VT-CH-190 and VT-CH-230 also show a use of secondary streams and drainage divide areas during the Middle Paleoindian period, indicating that these areas likely supported plant and animal communities important to people and had dried out enough to support at least short-term habitation. Finds from Bristol Pond show that this upland water body, like the Leicester River/Lake Dunmore area, was a destination, as it would be for millennia afterward. In an analogous setting, the Auclair site near Shelburne Pond helps highlight the importance of postglacial lake environments which, early on, attracted natural communities of plants, game, and at least seasonal habitation by Native people. Of note, although the sites and spot finds attributable to the Middle Paleoindian period include one of the highest-elevation sites in New England and the Maritimes, the mean elevation for the eleven sites/finds discussed above is 120 m (393 ft), or 24 m (79 ft) lower than the mean elevation for the smaller sample of Early Paleoindian sites/finds.

Late Paleoindian Period: Wetland and Riverine Adaptations

Over the course of the Late Paleoindian period the Champlain Sea had receded to a level more or less equivalent to modern lake levels, leaving an increasingly freshwater Lake Champlain in its place at or near the conclusion of the period. Formerly inundated areas hosted new ponds and wetlands that provided consistent resources. Forests became more varied with the addition of deciduous trees. Overall, Native Americans living in Vermont during the Late Paleoindian period witnessed some of the most dramatic environmental changes in the human history of the region. The margins of former estuaries of the Champlain Sea were still attractive, as evidenced by sites like Mazza and Arbor Gardens. These sites are located on similar outwash terraces above tributary streams which, by the Late Paleoindian period, took more meandering routes through newly exposed terrain instead of emptying directly into the sea as they had before. People began to inhabit lowlands, including formerly inundated areas. The mean elevation of the eight Late Paleoindian sites and finds discussed above is 95 m (312 ft), or 25 m (82 ft) below the mean elevation of Middle Paleoindian period sites and 49 m (163 ft) below the mean elevation of the Early Paleoindian sites. Remnants of the Champlain Sea or pockets of glacial ice in the form of ponds and kettles likely developed into concentrations of plant and animal resources. The Gonyeau projectile point comes from a location not only near the headwaters of a secondary stream that once drained directly into the sea but also near a probable postglacial, post-sea kettle pond. The area ringing this former pond (now wetland) was returned to for millennia, as evidenced by several multicomponent sites along its margins. The Arnold Brook site in Brandon also provides material evidence in the form of specialized tools that indicate that people had adapted to the newly available plant and tree resources and continued to utilize secondary stream corridors for specialized extraction.

Perhaps the most important new development in the Late Paleoindian period, however, is the settlement along main stems of major rivers (see figure 3.1 and location of Ste. Anne/Varney–related sites). By the Late Paleoindian period, rivers ran slower and warmer as a result of climatic change. The location of several sites both at lower elevations and immediately adjacent to major river channels in Vermont and elsewhere in the Champlain Basin indicates that, by this time, fishing began to be productive, not to mention that riverine travel likely was more feasible as a result of the rivers' reduced velocity. The advent of riverine adaptations is suggested by sites such as the Winooski Redevelopment site, the Bessette II site along the Mis-

sisquoi, and the Lower Saranac Prehistoric site across the lake (Hartgen Archaeological Associates 1991), as well as the Otter Creek 2 site on Otter Creek in Brandon. In addition to helping reconstruct Late Paleoindian settlement and adaptation, these sites also highlight the potential of lower river valleys for preserving as-yet-unidentified sites from this poorly known period.

Clearly, one of the most interesting aspects of Vermont's Late Paleoindian site inventory is the high proportion of New Hampshire rhyolite in the lithic assemblage from the Mazza site, as well as the appearance, for the first time, of Kineo felsite from the Moosehead Lake region of Maine. Whereas the likely presence of materials such as Onondaga chert is evidence of a broad sphere of interaction or travel, the presence of New Hampshire rhyolite and Kineo felsite indicates a continued strong connection with eastern regions. Following a millennium of settlement in the region, these materials also highlight what must have been a well-entrenched cognitive landscape, with the meaning and cosmological significance of place and the etiological origin of materials and source areas transmitted from east to west along with the raw materials. Mount Jasper/Jefferson and Mount Kineo sources are each impressive physically, visible from a distance, and associated with major waterways. By the Late Paleoindian period, these lithic sources were likely indistinguishable from the creation stories that explained their existence. We know less about Vermont materials moving in the opposite direction, but the same phenomenon likely occurred as well, with materials like Cheshire quartzite embedded with meaning, including geographic reference and the history of the Champlain Sea and Green Mountains landscape.

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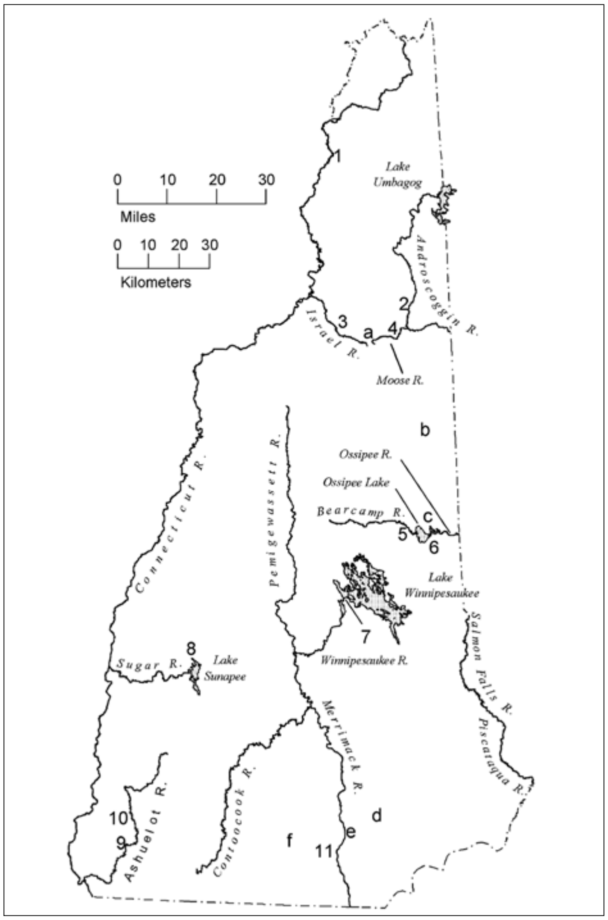
CHAPTER IV

The Paleoindian Period in New Hampshire

Richard A. Boisvert

Summarizing archaeological data from an arbitrarily defined space is always a risky proposition. Rarely is such a summary viewed as adequate or even valid. The effort is even more unreliable if data from within the selected area are known or believed to be uneven. Presenting a summary of Paleoindian data in New Hampshire is fraught with all of these liabilities. The area of the state is quite arbitrary from an ecological or cultural historical perspective, circumscribing only one major watershed, the Merrimack (and not even all of that), the east half of the Connecticut, the upper reaches of the Saco, the middle reaches of the Androscoggin, and a collection of minor streams that feed into a very small maritime zone. The White Mountains are perhaps the only environmental zone completely within the state. Systematic archaeological survey of the state does not exist. Sites have been found, but chance discovery accounts for about half of the sites recorded, and only one site (Thorne) was found as a product of a survey carried out specifically to find a Paleoindian site; the others were found as part of CRM surveys in advance of development. Paleoindian assemblages are overwhelmingly dominated by lithics, with scant representation of faunal or floral materials. When present faunal or floral archaeological materials are immensely informative and serve to remind us that the preserved data are profoundly biased. Finally, the number of sites that may be analyzed are painfully few in number, with sixteen partially excavated sites and eight reasonably well documented isolated finds of Paleoindian artifacts (figure 4.1). Among this total a third are from sites with Archaic or Woodland components, and their analyses are somewhat confounded with mixed assemblages. A summary of Paleoindian sites in New Hampshire is therefore constrained by several limiting circumstances.

Whether or not New Hampshire has a large or representative body of Paleoindian sites, it is still important and necessary to move forward with interpretations of the available data. These sites cannot be understood in isolation, and the larger questions regarding the Paleoindian period require a synthesis of all available data. Understanding the larger questions of origins, intergroup relationships, change over time, and ultimate closure of the Paleoindian period and culture can only be derived from interpretations of the patterns and differences among these sites. That they are imperfect is relevant only insofar as we are concerned with the absolute certainty of our conclusions.



4.1. Map of Paleoindian sites and isolated finds in New Hampshire. Sites: 1, Colebrook site, Colebrook; 2, Mount Jasper lithic source, Berlin; 3, Israel River Complex (Jefferson I, II, III, IV and V), Jefferson; 4, Potter site, Randolph; 5, Stone's Throw site, Tamworth; 6, Thorne site, Effingham; 7, Weirs Beach site, Laconia; 8, George's Mills, Sunapee; 9 Whipple site, Swanzey; 10, Tenant Swamp site, Keene; 11, Thornton's Ferry and Hume sites, Merrimack. Isolated finds: a, Lowe biface, Randolph; b, Intervale point, Conway; c, Ossipee Lake point, Freedom; d, Massabesic Lake point, Auburn; e, Smyth, Neville, and Manchester points, Manchester; f, New Boston point, New Boston.

HISTORY OF RESEARCH

1995 is an appropriate year to divide the research on the Paleoindian period in New Hampshire, for it was at this point that the first of the sites in the Israel River Complex (Bouras and Bock 1997) were discovered. This marked the beginning of a rapid accumulation of new sites, and by 2003 the total number of excavated Paleoindian sites had more than doubled to a modest total of fifteen. Mary Lou Curran had produced a summary of Paleoindian research in New Hampshire the prior year (Curran 1994) and of necessity developed her interpretations from the perspective of the Whipple site (Curran 1984, 1987), since it was the only well-published Paleoindian site in the state. Drawing from her own research and supplementing it with unpublished data shared by other researchers, she offered a broad summary of Paleoindian data in New Hampshire and sketched likely research issues.

The Whipple site was identified in the mid-1970s and immediately recognized as a rich and important Paleoindian site. This significance proved to be a two-edged sword, encouraging on the one hand commitment of significant resources from state and federal agencies, educational institutions, and the local community and unfortunately on the other hand looting by relic hunters. Field research documented three subareas or loci, two of which were Paleoindian encampments. The site is situated on the shoulder of a broad slope overlooking a sharp bend of the Ashuelot River and a former kettle pond that had been breached by the meandering of the river. A large assemblage of distinctive Paleoindian points and other tools were documented, both from the formal excavations and from collections made by local residents. Curran hypothesized a close relationship with the other well-known southern New England Paleoindian sites, stating, "The similarity, technologically and lithologically, of the Bull Brook and Whipple site materials [Curran 1984; Grimes et al. 1984] suggests that closely related groups occupied both 'ends' of the habitat scale and adjusted their exploitative strategies accordingly" (1987:304).

At that time there were only four other sites with excavated Paleoindian components in the state, most of which received publication a few years later: the Thorne site (Boisvert 2005) in Effingham, the Thornton's Ferry site (unpublished except for Curran's 1994 comments), the Hume site (Boisvert and Bennett 2004) in Merrimack, and the George's Mills site in Sunapee (Sargent 1982, 1990). Curran also incorporated data from the Weirs Beach site in Laconia (Bolian 1977, 1980) since it likely represented the transition from the Late Paleoindian to the Early Archaic. Of these sites only the Thornton's Ferry site consisted of an excavated component with a fluted point. In addition to these sites there were also a handful of individual finds of fluted points: a surface find on Ossipee Lake (Sargent and Ledoux 1973), isolated finds deep in the Smyth and Neville sites at Amoskeag Falls in Manchester (Curran 1994:43–45),

and a vaguely reported discovery made in 1888 by an artist in North Conway at a locale known as "The Intervale" (Sargent and Ledoux 1973:67).

Curran and colleagues (Spiess et al. 1985) concluded that we had only very basic data for the state, limited to confirmation of the presence of caribou and beaver hunters at small camps and estimated 10,000–11,000 ^{14}C years ago. She identified the need to resolve the internal chronology of the Paleoindian period, sorting out the variation in projectile point stylistics (which she saw as relevant to chronological issues) and lithic sourcing. The status of Paleoindian studies for New Hampshire by 1995 was at a basic presence/absence level with the expectation that much more was available to be learned. So meager was the database for Paleoindian sites in the state that Whipple was the only site that had produced more than one fluted point or triangular spurred endscraper.

The discovery of a fluted point base at the first of the Israel River Complex sites in Jefferson in the fall of 1995 prompted a series of investigations by the New Hampshire Division of Historical Resources through the State Conservation and Rescue Archaeology Program (SCRAP), which brought forward a series of Paleoindian sites and associated research. At the onset three sites were identified (Boisvert 1997, 1998a): Jefferson I, which contributed a pair of fluted point bases; Jefferson II, which developed into a large, multilocus campsite that was eventually purchased for preservation by the Archaeological Conservancy; and Jefferson III, a large multilocus site that may span nearly the entire breadth of the Paleoindian period (Boisvert 1998b, 1999a). Three seasons of field schools at the Jefferson sites contributed to an elevated public awareness of archaeological resources in the community, and a chance find by a landowner led to the discovery of two additional sites: Jefferson IV, a small, probable short-term hunting camp (Boisvert and Puseman 2002); and the nearby Jefferson V site, which contained lithic workshops and a lithic extraction locale. Field investigations at the Israel River Complex continued through 2004, and analysis of the sites is ongoing.

Significant advances were also made in other regions of the state. A CRM survey for a gas transmission line resulted in the discovery of a small Paleoindian site in Colebrook (Bunker and Potter 1999; Bunker et al. 1997). This site was revisited in 2006 as a SCRAP field school and significant additional data were obtained, including a greatly expanded lithic assemblage related to fluted point manufacture (Boisvert 2008). Another Paleoindian site, known as Stone's Throw, was found through a CRM survey in Tamworth adjacent to a lithic quarry (Ives and Leveillee 2005). This was a small component identified on the basis of a channel flake and Mount Jasper rhyolite debitage.

The Potter site in Randolph was discovered in 2003 and has been under annual investigation and the subject of three field schools. The site is large, in excess of three acres (1.2 ha), with at least eight areas of artifact concentrations. Comprehensive use wear analyses have revealed that woodworking was an important activity in at least two of the concentrations (Boisvert and Shoberg 2007; Rockwell 2010), and half of the concentrations exhibit evidence of multiple activities suggestive of household encampments. The site contains both Michaud/Neponset and Bull Brook/West Athens Hill style points and likely represents a repeated occupation over an undetermined, but substantial, time span within the Paleoindian period.

The most recently added Paleoindian site is the Jefferson VI site, found near the Jefferson IV and V sites in the summer of 2010. Initial survey recorded a small amount of debitage, a channel flake, endscraper, and biface fragment, and further survey and testing in 2011 has produced fluted point fragments and debitage made from exotic raw materials.

The increasing interest in Paleoindian research has also brought forward information on several isolated finds, some of which were made decades earlier, such as the Lowe biface found in 1947 in the Corrigan gravel pit in Randolph (Boisvert 1999a:163–164); an indeterminate style fluted point from Manchester and a Kings Road/Whipple style fluted point from nearby Auburn (Evans 1996), both recovered in the mid-twentieth century; and a Vail/Debert style point from New Boston (Boisvert 1994). Undoubtedly a review of museum and private collections would identify additional Paleoindian points whose general provenience might be found to be reasonably secure.

LITHIC SOURCING, GEOGRAPHIC SETTING, AND TYPES OF PALEOINDIAN SITES

Concurrent with site identification has been a significantly enhanced ability to identify the geological sources of lithics

Table 4.1. Paleoindian Sites and Isolated Finds in New Hampshire

Site	*Site Type*	*Approximate Size (m²)*	*Setting*	*Soil*	*Early Paleo*	*Middle Paleo*	*Late Paleo*	*? Paleo*
Colebrook	transient camp	25	riverine	alluvial		X		
Mt Jasper	quarry/workshop	>100,000	upland	till	X	X	X	
Jefferson I	transient camp	2500	upland	till		X		
Jefferson II	base camp	50,000	upland	till	X	X		
Jefferson III	base camp	100,000	upland	till	X	X		
Jefferson IV	transient camp	750	upland	till	X		X	
Jefferson V	transient camp/workshop	20,000	upland	till				X
Potter	base camp	12,000	kettle pond	till	X	X		
Stone's Throw	transient camp/workshop	500	upland	alluvial				X
Thorne	transient camp	100	wetland margin	outwash			X	
The Weirs	unknown	100	lakeside	alluvial			X	
George's Mills	transient camp	100	lakeside	alluvial				X
Thornton's Ferry	unknown	500	kettle pond	outwash	X			
Hume	unknown	100	kettle pond	outwash			X	
Tenant Swamp	transient camp	200	wetland margin	alluvial				X
Whipple	base camp	2,000	kettle pond	till	X			
Corrigan Pit	unknown		upland	outwash				X
Intervale	unknown		upland	outwash		X		
Ossipee	unknown		riverine	outwash	X			
Massabesic Lake	unknown		unknown	outwash	X			
Manchester	unknown		unknown	unknown				X
Smyth	unknown		riverine	outwash		X		
Neville	unknown		riverine	outwash				X
New Boston	unknown		upland	unknown	X			

found on Paleoindian sites. This research has been lead by Stephen Pollock, geologist at the University of Southern Maine. The first contribution (Pollock et al. 1996) was to clearly associate the Mount Jasper spherulitic rhyolite with Paleoindian assemblages at the Neponset site in Massachusetts and others in Maine. This had the logical consequence of recognizing Mount Jasper in Berlin, New Hampshire, as a Paleoindian site in its own right and facilitating identification of Paleoindian components on other sites. Pollock also clarified distinctions between two similar yet geographically distinct spherulitic rhyolites, Mount Jasper rhyolite from Berlin and the Jefferson rhyolite found naturally occurring at some of the Israel River Complex sites 25 km away in Jefferson (Boisvert and Pollock 2009; Pollock et al. 2007, 2008). This capability has expanded the range of research avenues and allows for finer-grained contextual analyses. Additionally, recognition of other raw materials from various known sources has benefited interpretation of Paleoindian settlement and movements across the Northeast (Bradley 1998; Burke 2006; Spiess and Wilson 1987).

The current database for New Hampshire Paleoindian sites currently stands at sixteen sites, not including Jefferson VI (table 4.1), plus half that many reasonably specific reports of isolated fluted points and one distinctive Paleoindian biface. The geographic and temporal spread of these sites is broad, covering a large part of the state, with gaps notably in the central portion of the Connecticut River drainage and the seacoast and adjacent hinterlands. This general lack of sites is viewed as a reflection of lesser survey effort and chance. Paleoindian sites are not recorded in the White Mountains, but few prehistoric sites of any age are reported there, and the lack of sites is also a likely result of the same factors. Systematic reconnaissance is needed to resolve this deficiency.

A few key site types emerge from this body of data: quarry-lithic extraction sites, lithic workshops, small-scale

hunter-forager transient camps, and aggregated base camps. Kill sites, though logically predicted have not been identified, nor have any ritual or burial sites been found. These site types are not necessarily mutually exclusive, and identification as to site function (or more properly functions at a site) is dictated by lithic data, which obviously introduces an interpretive bias. Furthermore, it is essential that we distinguish between actual large-scale aggregated base camps that supported multiple contemporaneous encampments and palimpsests of small-scale hunter-forager camps whose time span might range over many generations. Fine-grained data recovery and detailed analysis are essential in order to parse these distinctions. Finally, some sites may never be adequately categorized because of problems of site preservation or simply because of limited sampling in the field.

Mount Jasper is the premier quarry site in the state. The site had been known and recognized as a toolstone source for Native American populations since the nineteenth century (Haynes 1888), and it seems probable that the lustrous and colorful nature of the rhyolite prompted the name of the topographic feature. Near the Androscoggin River and close to east-west corridors that link the Connecticut and Androscoggin drainages, it is positioned well for access to much of the Northeast. Investigations on the summit near the mine and at the foot of the mountain clearly demonstrated the extractive nature of the site and the multiple associated lithic workshops (Gramly 1984; Gramly and Cox 1976) and eventually led to the listing of the site on the National Register of Historic Places (Boisvert 1992). Paleoindian components have not been documented at the site, although a few endscrapers and gravers attributed to the site have been on display at the community public library.

Prehistoric extraction and twelve millennia of occupation and use of the site could have thoroughly disturbed any Paleoindian components. As mentioned above, confirmation of the site as Paleoindian is based on recovery of abundant diagnostic tools made from this material at sites across the Far Northeast. It is not possible to address questions of how intensely the site was used, whether or not it also served as a long-term, multifunction encampment, or if it hosted groups from multiple bands whose annual rounds intersected at the site. Consequently, it is a key site for understanding Paleoindian movement throughout the Northeast, but many questions about Paleoindian behavior at the site itself are unanswered. The rhyolite dike that was mined prehistorically is one of at least nine known dikes in the vicinity (Billings and Fowler-Billings 1975), so the potential remains that other less prominent sources may yet be identified and other related sites may be preserved.

Understanding the lithic assemblage at the initial discovery of the Israel River Complex was confounded by the recovery of abundant small pieces of what appeared to be Mount Jasper rhyolite. Because they are small and useless as a toolstone, their presence ran counter to any normative explanation of lithic acquisition and use. Within short order it became clear that the rhyolite was native to the locality and represented a different, though superficially identical, material. Analysis of a large field stone that exhibited the contact of the rhyolite dike with the local bedrock revealed that the rhyolite in Jefferson was comagmatic to the Mount Jasper dike. Thus the Jefferson rhyolite represented a different source. The topography of the Israel River Complex is far gentler than that of Mount Jasper, and the rhyolite sources are covered by glacial till. Specific dikes have not been identified, although considerable survey effort has been expended to locate them. Areas of extensive and intensive stone tool manufacture, usually in context with other functionally specific activity areas, have been identified on several areas within the complex, similar to workshop areas found at Mount Jasper. In addition, all of the sites within the Israel River Complex are Paleoindian, with no evidence for later occupations. Lithic workshops have been identified at the Jefferson II, Jefferson III, and Jefferson V sites along with substantial blocks of glacial till with adhering rhyolite, or large cobbles composed completely of rhyolite. These three sites include lithic extraction among their demonstrable functions even though specific quarry pits or exploited boulders have not been identified. Thus the sites in Jefferson represent the inverse of the situation at Mount Jasper, where we know precisely where the raw material is found but we have no in situ Paleoindian artifacts.

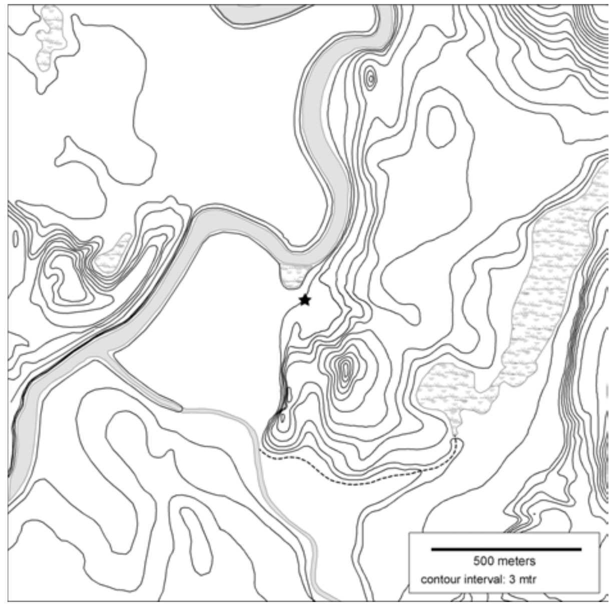
Rhyolites were not the only raw material available to Paleoindians in New Hampshire. A massive exposure of a black, cryptocrystalline, silica-rich rock is found on the north slope of the Ossipee Mountains in Tamworth. This material is widely distributed in New Hampshire and is

generally known as Ossipee hornfels, although a recent geochemical analysis indicates that it should be more accurately identified as an andesite (Gauthier and Burke 2011). Debitage and crude bifaces of this material have been found at the Thorne site, approximately 15 km southeast of the source. A highly weathered biface fragment and a small amount of debitage have also been found at the Potter site, some 60 km north of the source. Therefore there is evidence that the source had been used since Paleoindian times. More important is the small Paleoindian Stone's Throw site (Ives and Leveillee 2005).

The Stone's Throw site is small and identified as Paleoindian on the basis of a channel flake and biface fragment made of Mount Jasper rhyolite. Incorporated within the assemblage is an abundance of Ossipee hornfels/andesite suggestive of a Paleoindian usage of that source, which is adjacent to the site. Radiocarbon dates from the site, however, are uncomfortably late—8870 ± 40 and 8840 ± 80 ^{14}C yr BP (Ives and Leveillee 2005:23–24)—and may reflect a subsequent Early Archaic occupation. The Stone's Throw site offers a tantalizing association of Paleoindian raw material use and movement, but it remains difficult to integrate into the broader spectrum of known Paleoindian sites in the state.

Small camps created by hunters and foragers should be recognizably different from lithic workshop sites not only by their reduced physical size and small artifact inventory but on the basis of a restricted tool inventory, higher ratio of tools to debitage, and debitage that reflects later-stage rather than earlier-stage chipped stone tool manufacture. There are several examples of transient camps among the New Hampshire site assemblage. It is tempting to consider all of them to be short-term hunting camps, but the pernicious effects of differential preservation result in preservation of projectile points and the lithic debris from their repair and replacement whereas direct evidence of foraging is typically not preserved.

The Colebrook site (figure 4.2) stands as a short-term domestic site with a knapping station. A narrow range of tool production activity occurred in a small space of approximately 25 m^2, as evidenced by a near total lack of tool fragments, a modest amount of debitage (3,200 flakes), the tip of a point broken in the process of fluting, and some 73 channel flake fragments (Boisvert 2008). This assemblage, in context with small hearths and post or stake molds, indicates the presence of a small encampment where hunters were finishing the manufacture of projectile points, presumably in anticipation of a hunt in their near future.



4.2. Colebrook site and terrain overlooking the Connecticut River, Colebrook.

The Jefferson I site sustained only limited testing, and interpretations are therefore based on scant data, but it too appears to be a small-scale occupation where a pair of fluted point bases (one of which is clearly of the Michaud/Neponset variety) are accompanied by a pair of scrapers, four channel flakes, eight marginally retouched flakes, and just over 300 pieces of debitage. The site is relatively compact and, without any forest cover, would have had a commanding view over the Israel River valley, well suiting it as a hunter's camp and lookout.

The Jefferson IV site, located 0.8 km away, has a similar profile. Here the inventory consists of a complete Bull Brook/West Athens Hill point, a basal section of a Cormier/Nicholas point, and three unifaces accompanied by just over 200 flakes. The site is small in size and located on the landscape at an unmistakable vantage point overlooking the Israel River valley. In addition, cross-over immunoelectrophoresis (CIEP) analysis indicated the presence of cervid protein on a Munsungun chert flake (Puseman 2000). The flake is interpreted as resulting from rejuvenation of a butchering tool, consistent with activity at a hunting camp (Boisvert and Puseman 2002).

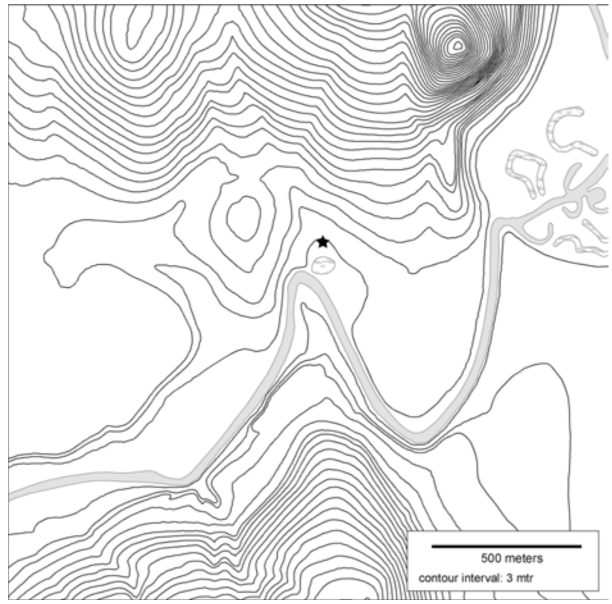
The Thorne site in Effingham may also qualify as a hunting camp, having the similar profile of small size and restricted breadth of tool forms: a nonfluted point base, a biface, three biface fragments, a hammerstone, and nearly 250 flakes. The point base conforms well to the Agate Basin–related points found at Cliche-Rancourt (Chapdelaine 2007:88) in Quebec as well as to various isolated finds in Maine and Massachusetts (Bradley et al. 2008:154).

Last, what appears to be another small transient camp, known as the Tenant Swamp site (Goodby 2009, 2010), was found in late 2009 on a CRM survey in Keene.

Small-size hunting camps should be common among northeastern Paleoindian sites, and these seem to meet expectations. Smaller sites are more difficult to discover, and sites with less dense artifact distributions even more difficult to recognize. Consequently, even this modest inventory of four sites among the sixteen would appear to meet our expectations, at least within the context of such a small sample size.

Base camps are a well-known, though often poorly defined, category. For the purpose of this discussion, base camps are essentially sites where various family bands would have aggregated and occupied the landscape for a substantial length of time, at least well beyond the supposed few nights of a transient hunting-foraging encampment, and where a wide variety of functions were executed. Among the New Hampshire Paleoindian sites these activities might include not only subsistence activities but also tool manufacture (lithic and nonlithic), hide processing, and other processing of animal remains taken on the hunt, such as bone and antler. Less tangible but certainly congruent with larger groupings of family bands would be social intercourse, exchange (of both goods and information), and ceremonial activities. The best examples of a base camp in the Northeast would be the Bull Brook site (Jordan 1960; Robinson et al. 2009) in northeastern Massachusetts and the Vail site (Gramly 1982) in western Maine. Ostensibly it would seem that identifying base camps would be comparatively easy, but there is the challenge of distinguishing between sequentially reoccupied sites with concentrated and overlapping activity areas and large sites with multiple simultaneous occupations.

The Whipple site in southwestern New Hampshire is a good example of a Paleoindian base camp. It rests on a



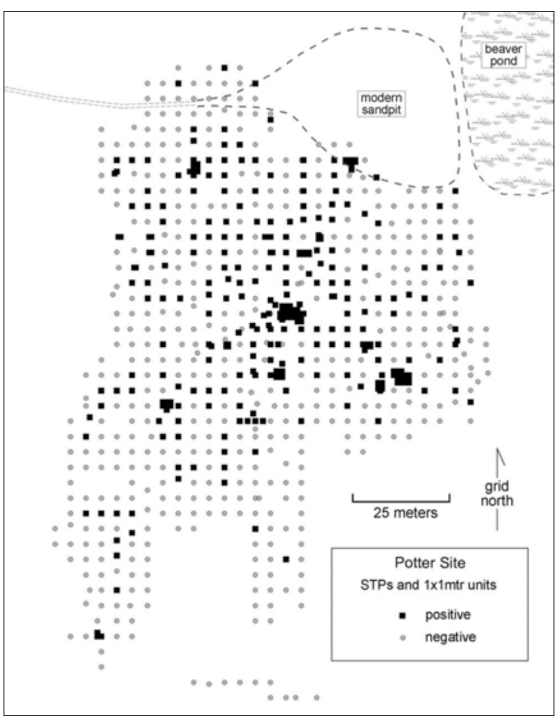
4.3. Whipple site and terrain near the Ashuelot River, Swanzey.

high slope overlooking a remnant kettle pond and a sharp bend in the Ashuelot River (figure 4.3). Curran's research identified at least two intensely occupied areas of the site, and recent CRM investigations by John Milner Associates identified another associated locus (Duranleau et al., n.d.). The Whipple site is viewed as a key site for the New Hampshire Paleoindian period. Not only did it present a large and varied material culture assemblage, it yielded radiocarbon dates and identifiable faunal remains. Even with the passage of over three decades, no other site has been as productive in such a broad manner. Curran (1987) interpreted the site through the lens of optimal foraging theory, a long-established perspective that attempts to explain how foraging populations most efficiently and effectively exploit their environments. She used this theoretical perspective to estimate the size and location of Paleoindian sites in the Northeast and argued that her model was generally useful in explaining the location and nature of her comparative set of sites (Vail, Debert, Bull Brook, Templeton, and Wapanucket 8). Although optimal foraging theory has had firm critics (Martin 1983; Pierce and Ollason 1987), it is still generally accepted within the broader perspective of behavioral ecology (Bird and O'Connell 2006) and continues to be an attractive approach for the understanding of Paleoindian hunter-gatherer culture in this region.

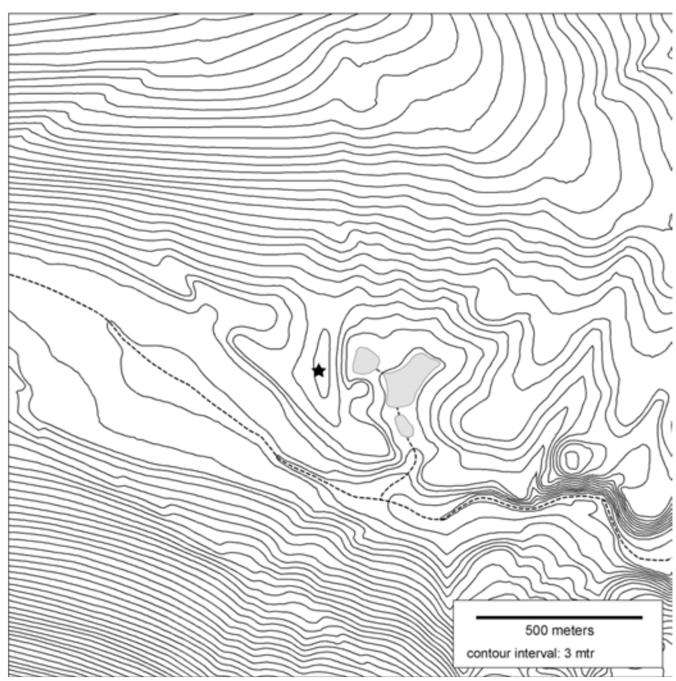
The other strong candidate for a Paleoindian base camp

is the Potter site at the other end of the state from Whipple. It is located in thick secondary growth forest and has been defined by rigorous placement of nearly 800 shovel test pits on a 4 m grid over the site area (figure 4.4). The site has produced eight defined subareas, three of which appear to be corollaries to the "hotspots" at Bull Brook and Whipple, and others may yet prove to be equivalent. The Potter site has some significant similarities to Whipple. Most readily apparent is its position overlooking a remnant of a glacial pond (figure 4.5). The broad topography of the site setting reveals that stagnant glacial ice trapped behind a moraine created a large kettle pond that would have covered well over 10 acres (4 ha). This water body eventually breached the impounding moraine and drained through a comparatively narrow gorge and entered the Moose River just to the south. Contemporary beaver have dammed the flow through the ancient kettle pond, flooding the remnant wetlands. This constellation of topographic features is extremely similar to the setting of the Whipple site, and both sites appear to be focused on the nearby drained kettle ponds/wetlands.

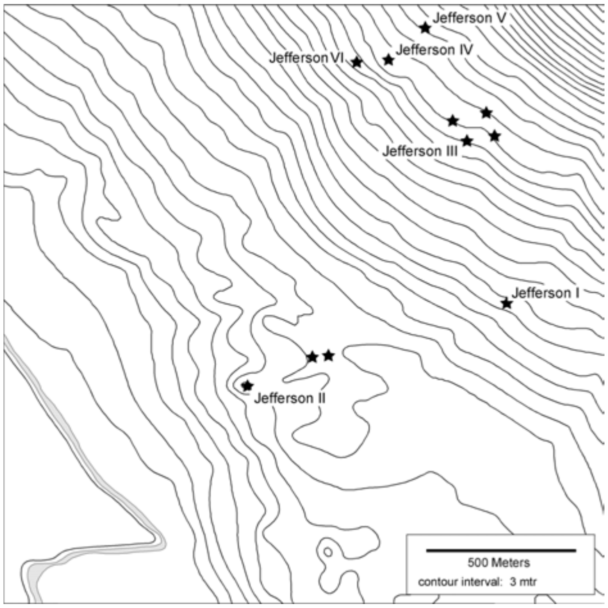
The Israel River Complex contains five defined sites (figure 4.6) and one recently discovered site of unknown size and function. It is arguable that the complex is either one large dispersed site or a series of at least six smaller sites that contain from one to at least six concentrations of artifacts each. Strong evidence for base camps is present at the Jefferson II and Jefferson III sites. Recent research at the Jefferson II site by Yvonne Benney Basque (2010) identified artifact distribution patterns within a 42 m^2 excavated block. Here she observed a distinct separation of tool types, with scrapers and edge-modified flakes present in proximity to hearthlike features distinct from a biface production area with a concentration of biface fragments, basal fragments of fluted points, and channel flakes. A smaller 9 m^2 block was excavated 50 m from this block, and its contents include a full range of tool types, replicating the inventory of the larger block excavation. Excavations at the Jefferson II site were prompted by a concern that it would be the location of residential construction, but purchase of the site by the Archaeological Conservancy (Crisell 1998) relieved this concern and field excavations were suspended. Consequently, we have a persuasive, though incomplete, body of data that indicates that the Jefferson II site was a base camp. The site also incorporates a prominent lookout with a commanding view of the whole Israel River valley, which likely served as an additional feature for the site. Diagnostic fluted point base fragments include Vail/Debert and Kings Road/Whipple points in the larger block



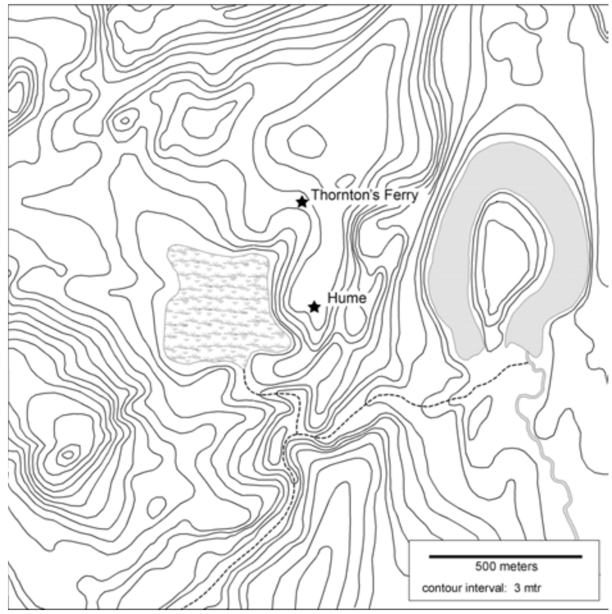
4.4. Potter site shovel test pits, Randolph.



4.5. Potter site and terrain, Randolph, with ponds and Moose River flowing east toward the Androscoggin River.



4.6. Israel River Complex sites and terrain overlooking the Israel River flowing toward the Connecticut River, Jefferson.



4.7. Thornton's Ferry and Hume sites and terrain adjacent to a drained kettle pond, now wetland, Merrimack.

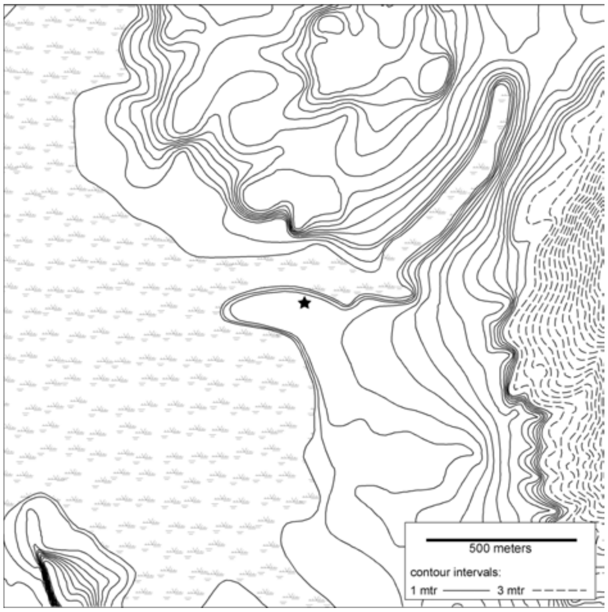
and Michaud/Neponset points in the smaller block at this site (Boisvert 2001; Bradley et al. 2008). It appears, then, that this site experienced a comparatively lengthy span of occupation.

The Jefferson III site was investigated over four seasons from 1996 through 1999, but the large expanse of the site, in excess of 100,000 m^2 with at least six loci, makes it difficult to categorize. Kings Road/Whipple and Michaud/Neponset point styles are represented at this site, and they appear to not be present at the same loci. One of the concentrations appears to have been an area where triangular endscrapers were used intensively (Hill 1999) in close proximity to the manufacture of Kings Road/Whipple points (which were initially identified as Gainey style points [Boisvert 1999b]). Confidence in the designation as a base camp is less secure for the Jefferson III site because of the limited extent of excavations (two blocks of 12 m^2 and 16 m^2), but the comparatively wide range of tools and density of debitage support a base camp interpretation of the site.

The Israel River Complex overlooks the former Glacial Lake Israel (Lougee 1930; Thompson 1999, 2000), which formed and drained prior to the arrival of the residents of the Israel River Complex sites (Dorion 2000, 2002). Jefferson II was approximately 200 m from the former lake shore, and the earlier Paleoindian component of Jefferson III was situated on a well-appointed vantage point approximately a kilometer away. The wetland association is reinforced at Jefferson III by the recovery of a water lily seed from a small pit feature (Boisvert 2002).

This trend toward association with wetlands is followed by each of the other proposed base camp sites, with Potter adjacent to a large drained kettle pond and a similar setting for the Whipple site. In addition, three other sites in the "unknown" site type category are in close proximity to wetlands: the Thornton's Ferry site with its Bull Brook/West Athens Hill style point, and the adjacent Late Paleoindian Hume site (figure 4.7). Both are adjacent to a drained kettle pond, now wetland, in Merrimack. The area of documented Paleoindian occupation on both sites was limited to only a few square meters. The situation is similar at the Thorne site in Effingham (figure 4.8), where a single Agate Basin–related point and a small sample of debitage and nondescript bifaces were recovered on a broad glacial outwash plain adjacent to a perennially watered wetland.

There is an evident association of Paleoindian sites with wetlands, especially former kettle ponds, in New Hampshire. This had been predicted and observed over thirty years ago. For Curran (1987:310), one of the key aspects of Whipple in terms of settlement patterning was its proximity to water. She speculated that given the environmental



4.8. Thorne site and terrain and wetland south of Ossipee Lake, Effingham.

conditions, assumed to be a mosaic of small patches, there would have been an advantage to placing settlements with larger populations close to intense and highly varied sources of nutritional and other resources. Association with standing water and wetlands had been a recognized theme in the interpretation of Paleoindian settlement in the Northeast. Curran and Dincauze (1977) set the tone on the discussion for the Northeast. Their emphasis was on using the presence of human occupations to help resolve the chronology of Glacial Lake Hitchcock and in so doing established a framework for Paleoindian research in the region. Nicholas (1980) reiterated this proposition and advocated systematic survey of former glacial lakes, with an emphasis on edge features such as strandlines and terraces. In fact, after assessing the immediate environment of the middle Connecticut valley Curran and Dincauze (1977:346) concluded that "the valley's attractiveness to human groups would have been greatest after the lake had drained." This point has been recently underscored with the discovery on the bed of Glacial Lake Ashuelot of a small transient camp in Keene on the margin of Tenant Swamp (Goodby 2009). This site is 8 km north of the Whipple site, and research (ongoing at the time of this writing) is exploring potential relationships between them.

It remains to be demonstrated whether the apparent association between Paleoindian sites and the margins of wetlands and water bodies is a product of actual subsistence and settlement preference or a reflection of site formation variables. As additional data have accumulated with an evident increase in sites located in these settings, the attraction to a causative association has become stronger. But the body of data is still small, and until a sufficiently reliable sample of sites can be obtained explanatory models for site distribution will remain speculative. However, in the absence of any competing explanations, it does appear that there is a strong relationship between late Pleistocene wetlands (which may have survived until the present day) and Paleoindian sites.

A consideration of Paleoindian upland sites does provide an additional perspective on site distribution patterns. Of all the sites, only the Israel River Complex sites, the Potter site, and the Mount Jasper lithic source are situated on till soils. With the exception of the Potter site, these sites are directly associated with lithic resources. Even though Mount Jasper overlooks the confluence of the Dead and Androscoggin rivers, it was occupied expressly for its lithic economic potential, and the proximity to these rivers is coincidental. The Jefferson sites possess examples of unmodified rhyolite either as large blocks (up to 65 kg), such as at the Jefferson V site, or as boulders from bedrock that exhibit rhyolite dike contacts, such as at the Jefferson II site. Information from landowners whose property lies between these two sites records the presence of similar boulders with rhyolite in stone walls bordering their agricultural fields. This supports the interpretation that the selection of these locations by Paleoindians was guided, at least in part, by access to these lithic resources. The Potter site stands somewhat in contrast to this pattern, being located on a well-drained till soil and not on or near a known lithic source. Other factors, potentially the proximity to the former kettle pond/wetland and placement in a comparatively narrow segment of an important east-west corridor, may explain its presence there.

What emerges from this review of Paleoindian site settings in New Hampshire is interplay between sites positioned so as to exploit resources on or very near wetlands unless they are drawn to a critical resource whose location is completely independent of hydrology, such as lithic sources. Interestingly, the larger and more intensely occupied the

site (Whipple, Potter), the clearer the association with wetlands, and in particular with kettle ponds. Additional sites that have not been intensively investigated may also share this distinction, such as the Thornton's Ferry site. Again, it needs to be emphasized that these observations are based on a small sample size, barely one site per century during the Paleoindian period, with uneven levels of archaeological investigation and with major gaps in geographic distribution within the state. Consequently, these are observations on the *distribution* of sites on the landscape, which should in no way be construed as a settlement *pattern.*

CHRONOLOGY AND POINT STYLES

Although the location of Paleoindian sites on the landscape is difficult to resolve, the chronology is far more problematic. Radiocarbon dates have been reported on six Paleoindian components in New Hampshire. Three of these sites returned dates that are too young to be consistent with the accepted dating of Paleoindian sites. As referenced above, the Stone's Throw site produced a pair of dates at approximately 10,000 cal BP, which would be approximately 1,000 years too late to be reasonably associated with fluted points. If the identification of the channel flake from that site is set aside, the dates would be viewed as acceptable as Late Paleoindian. Even younger ages were obtained from the Jefferson II and III sites. Dates of 8590 ± 60 ^{14}C yr BP (9580 cal BP) and 8090 ± 90 ^{14}C yr BP (8900 cal BP) were obtained from the A Block at Jefferson II (Boisvert 2000:6–7) and interpreted as the result of mixing of young charcoal into older cultural deposits by natural disturbance. Similarly, a date of 7930 ^{14}C yr BP (8800 cal BP) from a small feature at the Jefferson III site was interpreted as being clearly too young.

The Whipple site (Curran 1994:30, Table 1) has produced a large number of dated samples (fourteen), but the range in ages is extremely wide, stretching from 7400 to 11,600 ^{14}C yr BP, which would represent a range in calendar years from approximately 8,250 to 13,800 years ago. Even excluding the oldest and youngest dates, the confidence intervals for the dates are ±500–700 years. Consequently, the average dates reported by Curran of 10,250–10,360 ^{14}C yr BP (12,000–12,250 cal BP) must be viewed with reservation. The radiocarbon dates do support a Paleoindian age, but not with any precision within that range. In contrast, the Colebrook site does have a pair of radiocarbon assays that do appear to date the site rather precisely. Bunker et al. (1997:21) reported a conventional radiocarbon date of 10,290 ± 170 ^{14}C yr BP (12,080 ± 350 cal BP) from a hearth feature. A debitage concentration with channel flakes less than two meters from the hearth, and at the same depth, also contained datable charcoal that produced a second radiocarbon date (Kitchel and Boisvert 2011) of 10,220 ± 40 ^{14}C yr BP (11,940 ± 110 cal BP). This date in concert with an analysis of diagnostic channel flakes from the site (Boisvert 2008) identifies this single component locus as affiliated with the (Middle Paleoindian) Michaud/Neponset point style characterized with long fluted scars exceeding half the length of the points. Equivalent dates of 10,200 ± 620 ^{14}C yr BP, with an extended counting to reduce the standard error from the Michaud site (Spiess and Wilson 1987:84); 10,210 ± 60 ^{14}C yr BP from the Neponset site (11,920 ± 110 cal BP) (Ritchie 1994:105); and site 6LF21 in Templeton, Connecticut, with dates of 10,190 ± 300 ^{14}C yr BP (11,900 ± 490 cal BP) (Moeller 1980:31) and 10,215 ± 90 ^{14}C yr BP (11,920 ± 190 cal BP) (McWeeney 1994:157) lend confidence to this identification. The deepest component at the Weirs site produced a small lithic assemblage including a large sidescraper and a collaterally flaked biface fragment in association with a date of 9615 ± 225 ^{14}C yr BP (10,940 ± 300 cal BP) (Bolian 1980:124). The date was eventually interpreted as Late Paleoindian rather than Early Archaic, largely because the hornfels- and chert-rich assemblage was so distinct from the overlying quartz-dominated and biface-poor Early Archaic component (Maymon and Bolian 1992:118). Thus, just over a third of the excavated sites in New Hampshire have been radiocarbon-dated, and of these only two, or at the most three, may be considered to be confidently dated. This is a much lamented situation not only for New Hampshire but the Far Northeast as a whole.

Since the chronology of Paleoindian in New Hampshire is only tenuously tethered by radiocarbon dates, it relies heavily on comparative stylistics of diagnostic artifacts, principally projectile points. Bradley et al. (2008) have assembled a synthesis of modal forms of fluted and lanceolate nonfluted points with a proposed sequential chronology with modal forms that could be coeval (table 4.2).

Table 4.2. Fluted Point Temporal Sequence for the Far Northeast

Period	*Temporal Span*	*Diagnostic Points*
Early Paleoindian	~12,900–12,400 cal BP (~11,000–10,400 ^{14}C yr BP)	Kings Road/Whipple Vail/Debert Bull Brook/West Athens Hill
Middle Paleoindian	~12,200–11,600 cal BP (~10,300–10,100 ^{14}C yr BP)	Michaud/Neponset Crowfield-related Cormier/Nicholas
Late Paleoindian	~11,600–10,800 cal BP (~10,100–9500 ^{14}C yr BP)	Agate Basin–related Ste. Anne/Varney

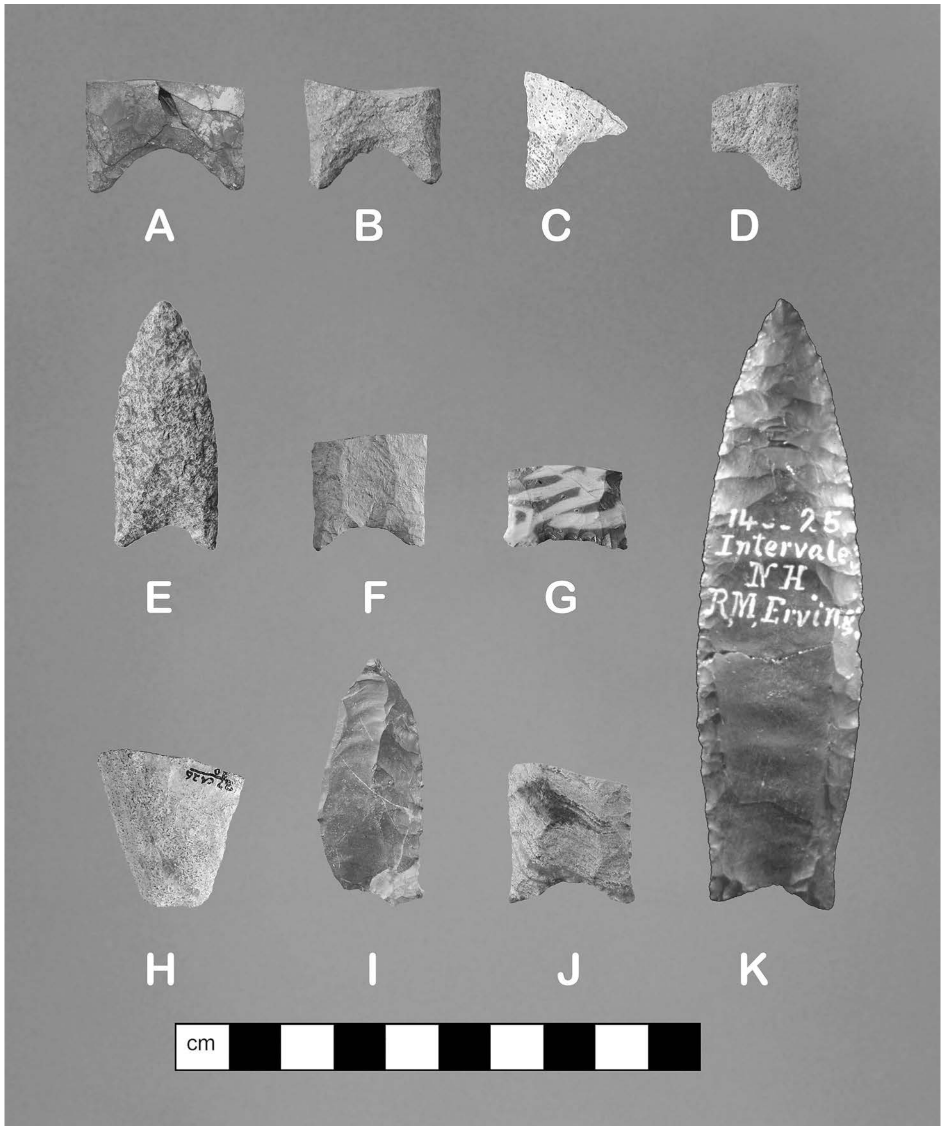
After Bradley et al. (2008).

Eight varieties of points are represented and, with caution, these variants may stand as cultural markers or proxies for subperiods or for cultural phases of distinct cultural trajectories (time series) within the Paleoindian chronology of the Northeast. They cannot be assumed to be fully extended over the whole region or temporally coterminous. Geographic sampling is far too limited and the dating of the points too vulnerable to problems of association or contamination. Still, this chronology is the best available and is applied here to the New Hampshire assemblages.

The earliest points are assumed to be the Kings Road/Whipple points. They most closely resemble Gainey style points from the Upper Great Lakes region and are present at the Whipple site, where the only concentration of early radiocarbon dates has been reported within the state. As discussed above, confidence in these dates must be reserved, yet their quantity does speak to a reasonable probability of an early component there. No other later styles have been reported from the site, but a reanalysis of the assemblage in light of new data acquired since Curran's 1994 summary would be welcome. Recent investigations at the Whipple site in relation to improvements of a power transmission line have brought to light another Whipple style point that appears to be made from Munsungun chert (figure 4.9A). If indeed this appraisal is accurate, it would indicate that the Munsungun source was accessed extremely early in the Paleoindian occupation of the Northeast. The only other Kings Road/Whipple point reported is the isolated find from Massabesic Lake in the southern part of the state. These two southern sites should not be construed as inferring a southern New Hampshire emphasis, for another such point has been reported much farther north, from Mexico, Maine (Bradley et al. 2008:128).

The Vail/Debert points are also considered to be Early Paleoindian by virtue of association with the eponymous sites where an abundance of early dates have been reported (Bradley et al. 2008:135). Again, the radiocarbon dates are somewhat equivocal at the Vail site, with wide ranges and substantial sigmas, and the interpretation of the Debert site dates is complex (see Rosenmeier et al., this volume), but the conclusion remains that these sites are best placed within the earlier portion of the Paleoindian period in the Northeast. In New Hampshire these points are documented on the Jefferson II and III sites (figure 4.9B–D) in the Israel River Complex as well as an isolated find in the town of New Boston (Boisvert 1994). The unusual deeply incurvate bases and comparatively restricted distribution have led some researchers to conclude that the makers of these points were a distinct social group (Bradley et al. 2008:135). Jefferson III points were found along with a comparatively high concentration of triangular endscrapers, replicating a pattern at the Vail site and suggesting the possibility of a broader pattern.

Bull Brook/West Athens Hill points have a comparatively broad distribution within the Northeast and are found across the length of New Hampshire. Curran (1994:42) illustrates such a point from the Thornton's Ferry site and finds it comparable to specimens from both the Bull Brook and Whipple sites. Sargent and Ledoux (1973) reported a rare intact specimen from the outlet of Ossipee Lake in east-central New Hampshire. Farther north, another rare example of a complete point (figure 4.9E) was found at the Jefferson IV site (Boisvert and Puseman 2002). Excavations at the Potter site in 2009 have produced two fragmentary bases (figure 4.9F) and what appears to be a late-stage preform that was abandoned just prior to removal of the channel flake. These were found within an area barely larger than a square meter and within a tool concentration of more than thirty specimens, including endscrapers, sidescrapers, and retouched flakes. Significantly, the two point bases and preform were all made from Mount Jasper rhyolite, indicating that the lithic source was also used at this early date. In addition, a basal section of a point



4.9. Paleoindian points from New Hampshire sites: A, Kings Road/Whipple point base, Whipple site; B, Vail/Debert point base, Jefferson III site; C, Vail/Debert point base, Jefferson II site; D, Vail/Debert point base, Jefferson II site; E, Bull Brook/West Athens Hill point, Jefferson IV site; F, Bull Brook/West Athens Hill point base, Potter site; G, Michaud/Neponset point base, Jefferson II site; H, Agate Basin–related point base, Thorne site; I, Michaud/Neponset point base, Jefferson III site; J, Michaud/Neponset point base, Jefferson I site; K, Michaud/Neponset point, Intervale site.

broken in the fluting process that retained a prominent projecting striking platform was found elsewhere on the site. This specimen is virtually identical to a pair of point bases recovered from the Bull Brook site (Bradley et al. 2008:139, Figure 12A–B). It should be noted, however, that two essentially identical unfinished specimens have been documented at Cliche-Rancourt, raising the possibility that this manufacturing technique likely was utilized on both forms. Still, the Potter site, previously thought to have been used solely by makers of Michaud/Neponset points, shows strong evidence of an earlier occupation. There appears to be a continuity of habitation over time, reflected in discrete occupational loci that have both definable differences in form and raw material and similarities to other sites in terms of lithic manufacturing technology and broader aspects of morphology.

The (Middle) Paleoindian Michaud/Neponset form is the most commonly represented point form in New Hampshire. The best example (figure 4.9K) is the remarkable Intervale point (Boisvert 1998a). Its provenience is poorly known and attributed by the finder only to Intervale, a village on the periphery of North Conway. It was recovered in 1888 and donated to the Smithsonian Institution a few years later. It exhibits the diagnostic characteristics of an extremely long flute length, sequential overlapping flutes, and well-ground recurved sides terminating in a flared base with a moderately incurvate base, rendering distinctive "ears." Point bases of this type (figure 4.9G–J) were recovered

from the Jefferson I, II, and III sites as well as from the Potter site. In addition, manufacture of Michaud/Neponset points has been documented at the Colebrook site based on analysis of diagnostic channel flake debitage and further confirmed by a pair of radiocarbon dates, as discussed above. Interestingly, this point style is not reported south of the White Mountains in New Hampshire, although it is well represented at the Neponset site itself, and with abundant point and channel flake fragments made from northern New Hampshire spherulitic rhyolites from Jefferson and Mount Jasper sources.

The (later Middle) Paleoindian Cormier/Nicholas points have a light footprint in New Hampshire. Only the Jefferson IV site, with a single point base, can be confidently attributed to this type. This site also has a Bull Brook/West Athens Hills component but fewer than 225 lithic artifacts. The sparse sample includes only three other tools (unifaces) and, as suggested above, appears to be a lightly used transient camp. Given its broad vista over the valley, it may have functioned only as a hunter's lookout on a few occasions widely spaced in time.

The Late Paleoindian nonfluted point tradition finds a limited expression in New Hampshire. The clearest example is the Thorne site in Effingham (Boisvert 2005), where a single Agate Basin–like base (figure 4.9H) was recovered close to the margin of a substantial wetland. This specimen was found in context with hornfels/andesite bifaces and debitage. The Ste. Anne/Varney variety of point has an ephemeral presence in the state. Debitage analysis at the Hume site (Boisvert and Bennett 2004) identified manufacture of points of this style in context with large chert sidescrapers also considered to be Paleoindian (Curran 1994:43). Bolian recovered a parallel-sided, parallel-flaked biface fragment made of black chert (see Boisvert and Bennett 2004:Figure 7) from the lowest levels of the Weirs site, which he concluded was a Late Paleoindian site.

DISCUSSION AND CONCLUDING REMARKS

Reviewing the Paleoindian chronology in New Hampshire, a few issues stand out. First and foremost is the lack of Clovis, not only in the state but in the Far Northeast. Hypothetically, the region could have been inhabited by makers of Clovis points, but so far there is no evidence in terms of either cultural assemblages or well-dated sites. The definitive criteria for Clovis points and, more important, for the broader Clovis material culture (Bradley et al. 2010; Collins 1999) make it clear that there are no documented Clovis assemblages in the Far Northeast. Prismatic blades and, more important, blade cores and debitage from their manufacture and maintenance are lacking in New England. Clovis style performs with intentional outrépassé, or overshot flaking, are absent. The nearest Clovis candidates would be the Shawnee Minisink and Paleo-Crossing sites in Pennsylvania and Ohio, respectively (Bradley et al. 2008:124), and though not exceptionally far away they are by no means within our region. This is not to say that there have not been applications of the term here. Unfortunately, Clovis is a term that has been casually applied in the Northeast and often inappropriately (including by me: Boisvert 2004). However, a careful reading of the data fails to identify any sites with Clovis assemblages.

This absence cannot be attributed to the presence of glacial ice blocking the landscape. All of New Hampshire was ice free at least as early as 11,500 ^{14}C yr BP (13,400 cal BP) (Ridge 2003), or more than 1,500 years before the Colebrook site was inhabited and the ice began its retreat from the southern part of the state 3,000 years before. Clovis predates or may only barely overlap the earliest defined variety of points, the Kings Road/Whipple style. Recent estimates of the parameters for the age of Clovis have narrowed the range to approximately 11,050–10,800 ^{14}C yr BP, which would calibrate to 13,250–12,800 cal BP (Waters and Stafford 2007:123). Even accepting a broader range, as advanced by Haynes (2002), there was sufficient opportunity for Clovis people to inhabit the Northeast.

Assuming that this absence of Clovis is not the result of some exceptional sampling error (it is difficult to accept that the efforts of dozens of archaeologists and hundreds of artifact collectors would have produced *no* Clovis points, blades, or blade cores had they been present), the answer must be an absence of that cultural expression. Whether that reflects cultural change over time before arrival of Paleoindians in the Northeast or the evolving epistemology of the archaeologists that redefines that cultural expression may be debated. Still, prior to the onset of the Younger Dryas, which coincides with the earliest documented sites,

the environment was relatively hospitable, at least by contemporary standards. The question therefore remains, why are there no Clovis sites or sites that fall within the Clovis time period in the Far Northeast?

Another, less ponderous problem is the relationship among the suite of Early Paleoindian sites. Based on projectile point similarities, Curran (1987:304) suggested contemporaneity and potential affiliation in the same subsistence system (Grimes et al. 1984) for the Bull Brook and Whipple sites. Brian Robinson et al. (2009) in a recent review of the Bull Brook site also see the two sites as being closely related. However, Bradley et al. (2008:126–131) see a distinction in the morphological variation between the points at the two sites. Recently obtained dates from bone at Bull Brook of 10,380 ± 60 and 10,410 ± 60 ^{14}C yr BP (Robinson et al. 2009:425) would indicate that the site is younger than previously estimated. Typologically, the points from Whipple appear to be distinct from the Bull Brook specimens, but a comprehensive presentation of the projectile point assemblage from Bull Brook is not yet available. Until it is, the correlation of the two sites should be suspended and consideration of a more complex interpretation of these two sites must be held open.

Perhaps the most important factor to emerge from this review of New Hampshire Paleoindian sites is the comparative importance of late Pleistocene wetlands and water bodies. Even granting the small sample size of sixteen excavated sites and eight isolated finds, the association is strong. Setting aside the Mount Jasper lithic source, nearly all of the sites are found with these associations. Whipple, Potter, Hume, and Thornton's Ferry overlook kettle ponds; Thorne and Tenant Swamp are adjacent to deep, well-watered, year-round wetlands; Colebrook and the Weirs were effectively on riverbanks, as were the find spots for the Ossipee, Smyth, and Neville associated fluted points. The Israel River sites have upland settings, yet they clearly face down the valley slope toward what was a large and attractive wetland. The maximum distance from any one of these sites to the wetlands was barely over a kilometer. Only the Corrigan Pit, where the Lowe biface is reported to have been found, seems to lack a nearby watercourse; it sits on the drainage divide between the Israel and Moose rivers. The assertions of Curran, Dincauze, and Nicholas from more than thirty years ago that these should be productive settings seem well placed. The discovery of the Tenant Swamp site made during the preparation of this volume serves as pointed example.

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CHAPTER V

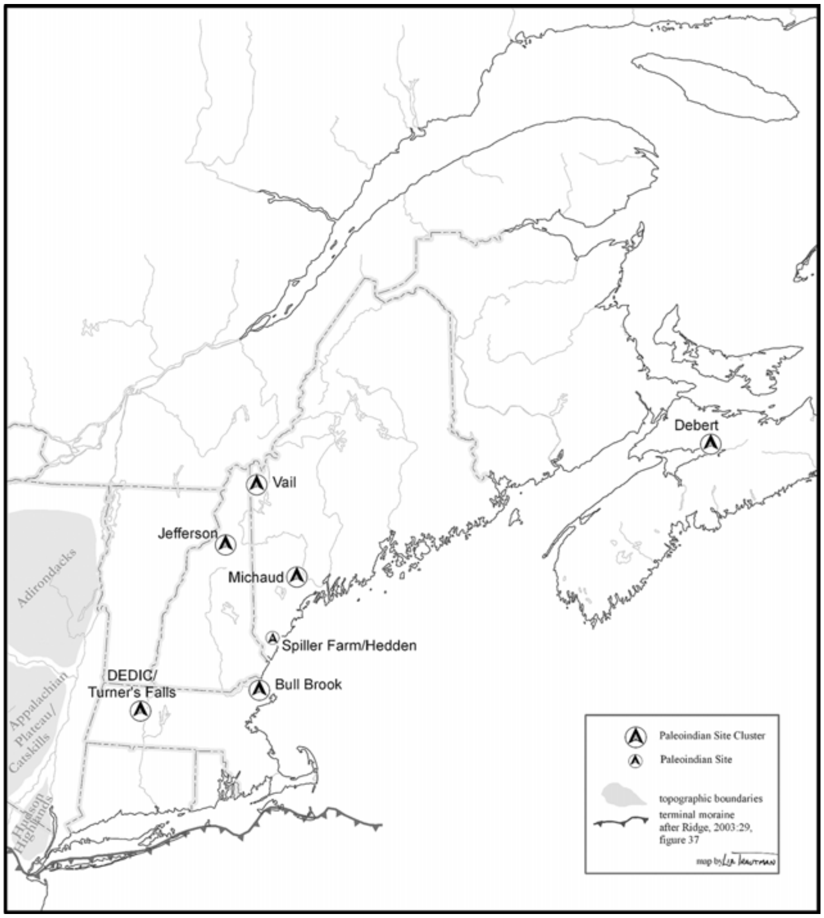
Geographic Clusters of Fluted Point Sites in the Far Northeast

Arthur Spiess, Ellen Cowie, and Robert Bartone

There have been many advances in Paleoindian research in the past ten years. The geographic boundary of fluted point sites in the New England–Maritimes region (Spiess and Wilson 1987:129) has been expanded into Quebec (Chapdelaine 2007). Bull Brook has revealed much greater spatial complexity in a large Paleoindian site (Robinson et al. 2009), and the Late Paleoindian Reagan site has been fit into the chronological and environmental picture of the Far Northeast (Robinson 2009). Much work has been done in geological and chemical descriptions of the lithic material used by Paleoindians, notably by Adrian Burke (2008) and Stephen Pollock (Pollock et al. 1999; Pollock et al. 2007, 2008). A sequence of fluted point and later Paleoindian point styles (Spiess et al. 1998:235–236) has been refined with attribute seriation and loosely attached to a radiocarbon chronology (Bradley et al. 2008). Calibrated date equivalents based on the radiocarbon chronology have allowed correlation of the Paleoindian cultural sequence with regional environmental changes based on pollen cores (Newby et al. 2005). This correlation highlights cultural continuity with slow environmental change over nearly 1,000 calendar years during the cold Younger Dryas climate episode, followed by rapid cultural and environmental change in the Far Northeast at the Younger Dryas/Holocene transition.

Recent Paleoindian site discoveries have been made in New Hampshire (Boisvert 1998, 1999), Vermont (Robinson and Crock 2006, 2007), Massachusetts (Binzen 2005), Connecticut (Jones 1997), Nova Scotia (Davis 1991, 2005), and now Quebec. Archaeological survey in Maine, mostly mandated CRM or government-funded archaeological survey, has resulted in the addition of many Paleoindian sites to the Maine archaeological survey records (Spiess and Newby 2002; Spiess and Trautman 2003) in the past thirty years. Between 1980 and 1998, fifty-one sites with fluted point or general Paleoindian age components were found, along with twenty-two sites with Late Paleoindian components. Between 1999 and 2009, another twenty sites with Paleoindian components and six sites with Late Paleoindian components have been discovered. Some of these sites are published (Spiess and Newby 2002; Spiess et al. 1998:203–206, map and table; Bradley et al. 2008 for references), but many are known only in file reports or Maine Historic Preservation Commission survey records.

Discovery of many Paleoindian sites in the past decades has allowed us to recognize geographic clusters or groups



5.1. Geographic clusters of Paleoindian sites in the Far Northeast

of sites (figure 5.1) based solely on geographic proximity (Bradley et al. 2008:119). Paleoindian sites in the region are generally "single component" and are probably therefore of short-term occupation (Spiess 1984). What then are the geographic clusters of Paleoindian sites? Do all of the sites in a geographic cluster represent the same short-term reuse of an area, with only one point style? The range of style variation among sites in geographic clusters is the subject of this chapter.

If we examine these geographic clusters of sites for the forms of fluted points on them, we can, in an inexact way, see the range of time that each geographic area was useful to the Paleoindians. Looking at the lithic raw materials allows us to examine the range and variation in Paleoindian movement to and from each place. We list some of the probable geographic clusters of sites below and examine two of them (Vail cluster and Michaud cluster) in detail. First, however, we review the sequence of Paleoindian point forms and paleoenvironmental context.

FAR NORTHEAST PALEOINDIAN SEQUENCE

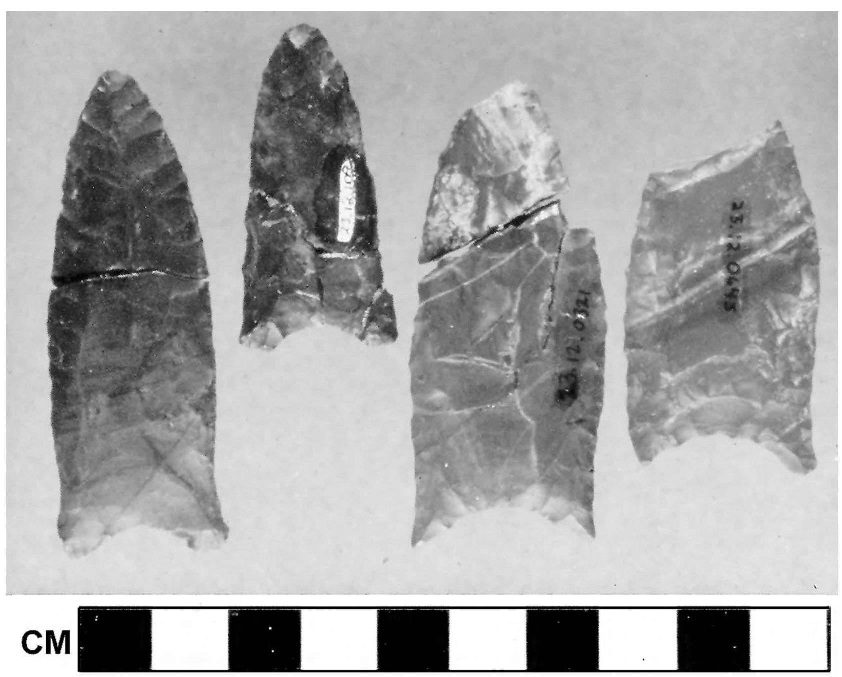
Looking closely at the variability in fluted point and other Paleoindian point forms in the Far Northeast, one can construct a seriation and a time sequence. The most recent iteration of the sequence is by Bradley et al. (2008). The seriation of point forms runs from larger points, measured primarily by basal width and maximum thickness, to smaller points. We are encouraged that the seriation is a true sequence of change by the fact that the modest radiocarbon record progresses from oldest to youngest (in contrast to proclamations of radiocarbon date confusion [e.g., Levine 1990]). In addition, we note a rapid change in point form that coincides with the end of the Younger Dryas event and rapid environmental change (Newby et al. 2005). The change in point form includes a "degeneration" of fluted point technique and replacement by various non-fluted Late Paleoindian styles. Thus, the sequence of forms

and chronology seem to be logical, but they could be falsified by contrary evidence such as a securely dated site with a "wrong" fluted point style.

Moreover, we are not certain that the point forms that have been named within the sequence of fluted points are "styles" with perceptible boundaries to variation, or whether the archaeological record has by chance shown us well-spaced variability on an indivisible continuum. Only the accumulation of more sites and points will test this hypothesis.

There are no Clovis points in the region (Bradley et al. 2008). Clovis points are generally the earliest fluted point type across most of North America (Haynes et al. 2007; Watters and Stafford 2007; 13,125–12,925 cal BP). Their absence probably means that the region was not populated at the time. The nearest recognizable Clovis points to our region may be at the Shawnee Minisink site in Pennsylvania (Gingerich 2007; 12,950–12,800 cal BP).

The fluted point sequence in the Far Northeast begins with the Kings Road/Whipple form (Bradley et al. 2008:126–130, estimated 12,900–12,500 cal BP). These are large, robust points with a moderately deep basal concavity and single flutes of moderate length on each face. The Vail/Debert form follows (Bradley et al. 2008:130–136), also generally large points but with a deep basal concavity. They may overlap Kings Road/Whipple points chronologically. Bull Brook/West Athens Hill style points are less robust than earlier points, the sides may be slightly divergent, and they may have small basal "ears" and moderate depth basal concavities (Bradley et al. 2008:137–141). Bull Brook has recently been radiocarbon-dated to approximately 10,400 BP (12,600 or later cal BP) (Robinson 2009:425); thus Bull Brook is not the first site in the region by many hundred years, despite some contrary published opinions (Dincauze 1993). The Michaud/Neponset form (figure 5.2) follows Bull Brook/West Athens Hill (Bradley et al. 2008:141–146; ca. 12,200–11,900 cal BP). Michaud/Neponset points are medium to long points with slightly divergent sides, long channel flakes, and prominent basal ears. The Crowfield form follows (Bradley et al. 2008:146–148) with unknown chronological overlap. Crowfield points are rare in New England but easily recognizable. They are large, thin, and have strongly divergent sides. Cormier/Nicholas points are last in the fluted point sequence, broadly equivalent to Holcombe points in the Great Lakes (Bradley et al. 2008:148–152). One radiocarbon date of 10,090 BP (ca. 11,600 cal BP) may be applicable. Cormier/Nicholas points are narrow on the base, often thin, and with "weak" fluting. Many of these points are characterized by a planoconvex cross section, with the ventral side preserving a minimally retouched flake surface from a larger flake preform.



5.2. Four points from the Michaud site

There are at least two Late Paleoindian point styles in the Far Northeast, a poorly understood Agate Basin–like group (Bradley et al. 2008:152–156) with points with sides divergent from a narrow base, and Ste. Anne/Varney points (Bradley et al. 2008:156–161) that are often parallel-flaked, long, and thin. Ste. Anne/Varney points may date as late as 10,600–10,000 cal BP, and they may represent a separate migration into the region (Dumais 2000).

There are a set of metric and nonmetric attributes for each of these point forms, with ranges of variation based on known samples (Bradley et al. 2008). We refer to these attributes for guidance in matching some points from specific sites and cite appropriate data later.

PALEOENVIRONMENTAL CONTEXT

The occupation of the Far Northeast by fluted-point-using Paleoindians is closely contemporary with the Younger Dryas chronozone. Here we summarize a recent (Newby et al. 2005) examination of regional pollen data sets at 1,000 calibrated year intervals to characterize regional vegetation cover from 14,000 to 10,000 cal BP. Within this time frame, the Younger Dryas lasted from approximately 12,900 to 11,600 cal BP. Pollen maps for earlier than 11,600 cal BP show large areas of open sedge "tundra" in northern Maine, New Brunswick, Nova Scotia, and the eastern townships of Quebec, grading to open spruce woodland in southern Maine and perhaps denser spruce-pine mixed forest in southern New England. The Younger Dryas is evident as a slight shift of spruce pollen southward and expansion of open sedge "tundra" in the Maritime provinces compared with the 14,000 cal BP conditions. In other words, the Younger Dryas represents a "pause" or slight reversal of considerable length in the postglacial vegetation trend. Rapid forest growth after 11,600 cal BP covered Maine with dense mixed forest by 11,000 cal BP, with a surviving remnant open spruce-sedge woodland in northern New Brunswick and Nova Scotia.

The Younger Dryas vegetation conditions in the Far Northeast are similar to recent broad patterns of vegetation cover on the Labrador-Quebec peninsula suitable for the development of one or more long-distance migratory herds of caribou (Newby et al. 2005:150–151). The fringe of open spruce woodland and denser woodland in southern New England may have supported smaller, locally migratory caribou herds as well as providing winter habitat for long-distance migratory herds. Faunal remains, mostly calcined bone fragments, clearly support some sort of caribou-hunting adaptation by Paleoindians using fluted points in the region (Robinson et al. 2009; Spiess et al. 1998:204–211). The caribou-hunting focus must have been seasonal in nature, again by analogy with recent environments and ethnographic accounts (Spiess 1979), although seasonality and intensity of focus on caribou may have been variable across the region.

The Atlantic shoreline during Paleoindian occupation is now offshore, under up to 65 m of water in the central Gulf of Maine. Maximum regression (land exposure) appears to have coincided with Paleoindian immigration, so the shoreline during Paleoindian occupation was rapidly transgressive (rising). Robinson (et al. 2009; Pelletier and Robinson 2005) proposed now-underwater exposed land masses such as Jeffrey's Ledge as summer caribou refuges. However, localized ecological conditions of the shoreline, and possible Paleoindian adaptation to them such as littoral foraging or maritime hunting, are unknown so far.

To the west, the region was bounded by a series of proglacial lakes in the Champlain and Memphremagog basins (Richard and Occhietti 2005) and the Hudson River corridor and Connecticut River, associated with the retreat of glacial ice. Recent examination of varve records and accelerator radiocarbon dating indicate glacial ice retreat north of the Vermont-Quebec border by 13,700–13,400 cal BP (11,700–11,400 ^{14}C yr BP [Ridge 2003, 2004]) and formation of large glacial Lake Vermont. The final drainage of the large proglacial lakes as the ice retreated north of the St. Lawrence and flooding of the depressed upper St. Lawrence and Champlain basins to become a marine Champlain Sea occurred at roughly 11,100 ± 100 BP ^{14}C yr BP (ca. 13,200–12,900 cal BP [Richard and Occhietti 2005]). Thus, the final drainage of proglacial lakes to the west, inception of the Younger Dryas, and initial Paleoindian settlement of the New England–Maritimes-Quebec region are roughly concurrent in time.

Because postglacial rebound occurred during the time of the Champlain Sea, Champlain Sea shorelines are now above water. Loring (1980) postulated Paleoindian occupation of the Champlain Sea shore as a maritime or littoral

adaptation, based on fluted points associated with fossil shorelines. The Reagan site in Vermont (Robinson 2009) is clearly associated with a Champlain Sea estuary (Robinson 2008). Robinson (2008) has demonstrated sequential Paleoindian use of land exposed by retreat of the Champlain Sea with postglacial rebound. The extent of Paleoindian adaptation to marine shorelines is still an open question, but the evidence from Vermont tends to support such an adaptation.

Archaeologists (Fitting 1965; Fitting et al. 1966; Funk 1972:30; MacDonald 1968:116–117; Spiess et al. 1998:227) have for decades recognized the geographic placement of regional fluted point Paleoindian sites as logical in terms of caribou hunting camps. As discussed above, the faunal data and paleovegetation reconstructions support this interpretation. Given a maritime coastal adaptation by Paleoindians using fluted points in the region, including the Quebec City area (see Pintal, this volume), the repetitive settlement patterns of Paleoindian sites as limited-term occupations on generally well drained soils (e.g., Maine; Spiess et al. 1998) must be an *interior* (or noncoastal) adaptation. We now focus on an examination of the phenomenon that many of these sites appear in geographic clusters.

DEFINITION AND LIST OF GEOGRAPHIC CLUSTERS

A remarkable number of Paleoindian sites in the Far Northeast, and the abutting Great Lakes region to the west, preserve intrasite patterning in the form of "concentrations" of stone tool debris separated by seeming sterile space, which we presume means contemporaneity of occupation or reoccupation at a short enough interval to avoid the garbage produced by previous inhabitants (Spiess 1984). Viewing Paleoindian site maps at the same scale (Spiess et al. 1998:Figure 13; the Bull Brook map notably now revised by Robinson et al. 2009) raises interesting questions about the scale of concentrations visible in plowed field sites such as Fisher and Parkhill versus sites that are less disturbed. In any case, each multilocus "site" covers a distance between 100 m and 400 m.

Leaving aside the meaning of that scale of variation, in this chapter we explore geographic clusters of Paleoindian sites at a slightly larger scale, the presence of several to many sites within a diameter of a few kilometers. Some concentrations of Paleoindian sites in the region focus around available, high-quality lithic material. Several Paleoindian sites (e.g., Bonnichsen 1982) in the Munsungun Lake region of northern Maine are a clear example, associated with a variety of Ordovician chert outcrops (Pollock et al. 1999). The sites in the Israel River Complex (Boisvert 1998, 1999) in Jefferson, New Hampshire, are also probably there because of stone quarrying. Part of the attractiveness of the Jefferson area to Paleoindian people in the region is bedrock outcrops of a local rhyolite and boulder till field of a closely related rhyolite (Pollock et al. 2008). But some geographic clusters of Paleoindian sites are not located near quarries, so stone quarrying was not the reason for reuse of an area in all cases.

Possible geographic clusters of fluted point Paleoindian habitation sites have been found in the northern, central, and southern parts of the region. We return to the Vail and Michaud clusters of sites, in northwestern Maine and central Maine, respectively, in greater detail after a brief review of other possible or known site clusters in the region.

The well-known Debert site near Truro, Nova Scotia (MacDonald 1968), has at least five other sites located within a few kilometers, known as Belmont, Belmont II, Hunter Road, and others (Davis 1991, 2005). These sites are known to contain fluted points or are strongly suspected to be Paleoindian sites on the basis of lithic materials and flake tools such as endscrapers. The Belmont I site (sixteen concentrations) is larger than Debert (approximately eleven concentrations), and the Belmont II and Hunter Road sites are smaller than Debert. Ongoing archaeological work and stewardship of these sites are being lead by the Confederacy of Mainland Mi'kmaq (see Rosenmeier et al., this volume).

There are multiple habitation and habitation/workshop sites in the Israel River valley near Jefferson, New Hampshire (Boisvert 1998, 1999; Boisvert and Puseman 2002), as mentioned. At least six sites are known, including sites with Vail/Debert point forms (Jefferson II and III), Michaud/Neponset point forms (Jefferson I and III) (Bradley et al. 2008), and probable Bull Brook point forms (Richard Boisvert, personal communication, October 2009).

Two sites in Kennebunk and Wells, southwestern Maine, are separated by about 7 km and may represent an incompletely known site cluster: the Hedden site (Spiess et al.

1995) and the Spiller Farm site (Spiess and Newby 2002; Spiess et al. 1998:217). The Hedden site is radiocarbon-dated at 10,550 BP, without diagnostic points. The Spiller Farm site contains points with moderately deep basal concavities that could be either Vail/Debert or Bull Brook/Kings Road points forms, as well as a point that is clearly a Michaud/Neponset form point.

The Bull Brook site (Byers 1954) and a nearby, smaller companion, Bull Brook II (Grimes et al. 1984), are located in northeastern Massachusetts. The ring-shaped pattern of thirty-six discrete loci at Bull Brook, with its own internal organization (Robinson et al. 2009), contains as many or more loci or concentrations as any of the geographic clusters of sites that we currently know. Bull Brook, therefore, represents an alternative spatial organization to be understood on its own terms and in relationship to the geographic cluster phenomenon we explore herein.

Finally, there may be a cluster of three or more fluted point Paleoindian sites in the Connecticut River valley in western Massachusetts, near Amherst. These include the DEDIC/Sugarloaf site (Gramly 1998), and the Turner's Falls site (Binzen 2005), and at least one other lesser known site (J. Bradley, personal communication, October 2009).

Thus, the phenomenon of geographic clusters of fluted point Paleoindian sites is not limited to one portion of the region. The remainder of this chapter includes an examination of the sites that make up the Vail and Michaud geographic clusters, because these two geographic site clusters are well known to us. The majority of the sites in the Vail cluster have been published (Gramly, 1982, 1988), and many of the artifacts are on display in the Maine State Museum's "12,000 Years in Maine" exhibit. Thus, information on the Vail cluster is more accessible than that for any other large site cluster in the region. The sites in the Michaud cluster have been investigated primarily by us, and much of the information provided herein is being published for the first time.

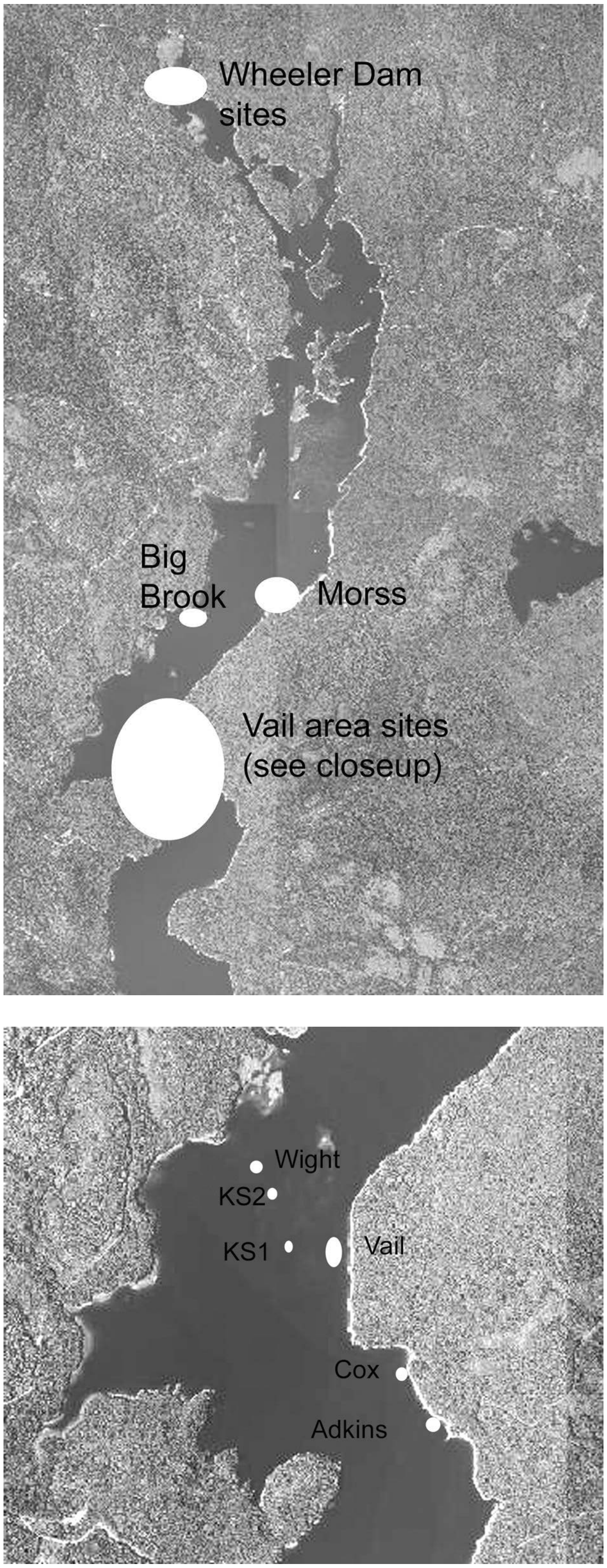
One hypothesis would be that all sites in a geographic cluster were used (deposited) in a limited time, perhaps one or a few seasons of use of the area. To test this hypothesis, we use the finer fluted point modal form sequence of Bradley et al. (2008). We wish to investigate if all sites in a geographic cluster are from the same time period as indicated by fluted point form. If not all the fluted points in the sites of a geographic cluster are of the same form, then the cluster was created by Paleoindian activity over a period of some time depth (perhaps centuries). Therefore, whatever attracted people to the area was a factor that lasted for some time during the Younger Dryas.

THE VAIL GEOGRAPHIC CLUSTER

The Vail site geographic cluster is located in a mountain valley in northwestern Maine near the Quebec–New Hampshire border (figure 5.3). The cluster comprises three habitation sites, two nearby "kill" sites, and three smaller sites that may have been special-purpose or limited-activity areas. The largest of these sites, the habitation sites, are the Vail site (Gramly 1982), Adkins site (Gramly 1988), and Morss site (Gramly 2001). The eight sites are spread over a distance of just less than 4 km along the former Magalloway River valley, exposed by erosion under the fluctuating Aziscohos Lake impoundment. In addition, there are two other Paleoindian habitation sites, the Upper and Lower Wheeler Dam sites (Gramly 2005a, 2005b), located 8 km farther north up the valley from the Vail/Adkins/Morss group. We include the two Wheeler Dam sites in the Vail geographic cluster, making ten sites total.

Survey coverage of the devegetated Aziscohos Lake bottom has been extensive during low-water conditions (Gramly 1981, 1982, 1988, 2001, 2005a, 2005b). The many square kilometers of soil exposure allow confidence that all large and medium-size Paleoindian sites in the valley have been located. Archaeological survey has been completed around several other large lake basins within a 20 km radius of Aziscohos Lake without locating more fluted point Paleoindian sites. Thus, we are reasonably certain that the Vail geographic cluster is unique within that radius and substantially completely identified. Gramly (1988:10–11) refers to these sites as the "Magalloway Valley Paleoindian Complex," in the sense of a limited time and geographic area cultural unit—specifically, "a brief period of New England culture prehistory, likely a single phase as evidenced by the similarity of projectile points from all components." In fact, we disagree with the interpretation of the range of variability in the points from these sites, as we describe below.

As mentioned above, there are limited-purpose sites



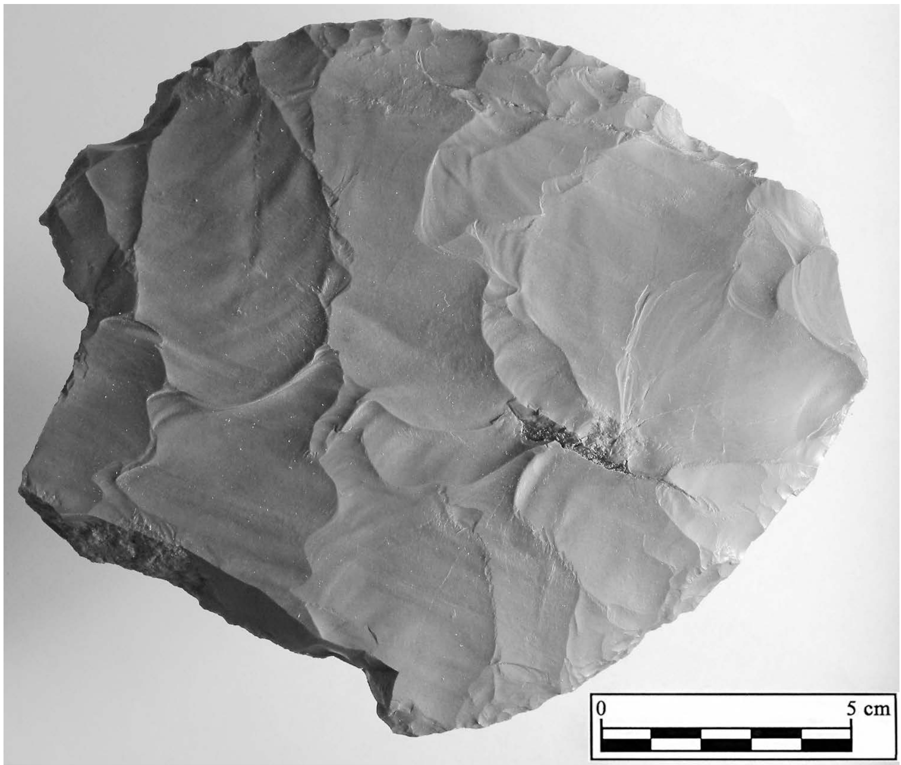
5.3. Vail geographic cluster in the flooded Magalloway River valley (Aziscohos Lake). KS1, KS2 = Kill Site 1, Kill Site 2

interpreted as kill sites in the Vail geographic cluster (Gramly 1984). Vail Kill Site 1 (site 81.1b) is located about 280 m west-northwest of the Vail site. It is obviously associated with the Vail habitation site, demonstrated by refits of at least a half-dozen fluted point tips from the kill site with bases recovered from the habitation site. This pair of uniquely related sites provides a geographic scale baseline of Paleoindian camp location from kill site (0.3 km). Kill Site 2 (site 81.13), represented by two fluted points and no debitage, is 650 m northwest of the Vail site.

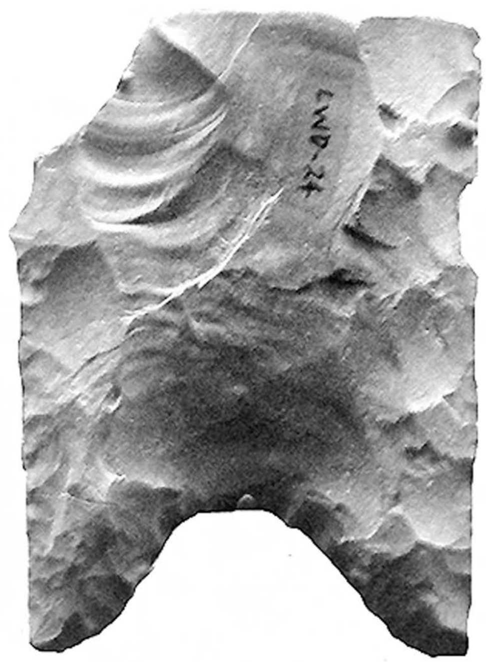
As mentioned, there are three smaller sites that are neither kill sites (containing fluted points exclusively) nor larger habitation sites—the Wight, Cox, and Big Brook sites (Gramly 2005b)—but none of the three produced a "diagnostic" fluted point fragment. The Wight site yielded five large biface and flake tools, including a backed sidescraper, ovate biface tip, and pièce esquillée (wedge). The Wight site is only 100 m from Kill Site 2 and about 700 m from the Vail site. Gramly (2005b:75) thinks that the broken large biface tip might match a biface base from the Vail site, and that the Wight site is a processing or butchery locality. The Cox site (Gramly 2005b:68) is a site of two small activity loci yielding a total of 40 artifacts, including an awl, channel flakes, a biface fragment, and biface reduction flakes. It is located between the Vail and Adkins sites. The Big Brook site is located on the opposite side of the valley from the Morss site. Six tools from the site—two biface preforms, a large sidescraper/cutter combination tool, an ovate biface knife, and two retouched flake tools—are made from a range of Munsungun cherts similar to those found at the Morss site (Gramly 2005b:68).

The diversity of site types in the geographic cluster may also include a cache (from an unknown location, no site number assigned) similar to western North American Clovis caches in the sense of having large flaked bifaces and little else (figure 5.4). A summer resident found two of these large biface knives on the Aziscohos Lake shoreline, many decades ago, presumably together without other artifacts. One of the specimens is extant, the other lost.

Fluted points have been recovered from all but the three smaller sites (Wight, Cox, and Big Brook). The points from the Vail site are deeply indented on the base and very large. The channel flakes do not extend more than halfway down the point, and basal ears are absent. This distinctive



5.4. Aziscohos large biface made of red Munsungun chert



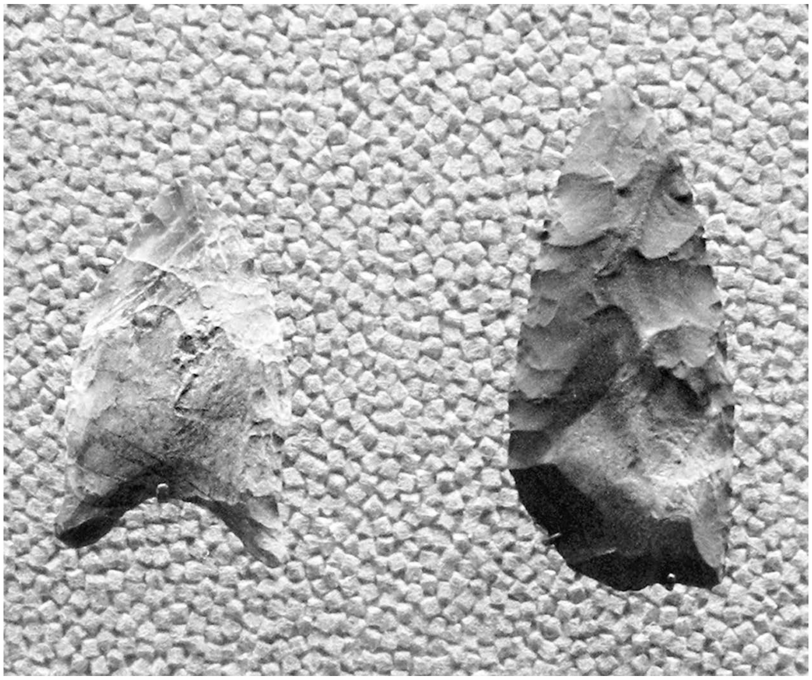
5.5. Lower Wheeler Dam site point. This is a deeply indented, Vail/Debert form fluted point.

fluted point form is also seen at the Debert site (Bradley et al. 2008) and can be differentiated from presumably later styles, as discussed above.

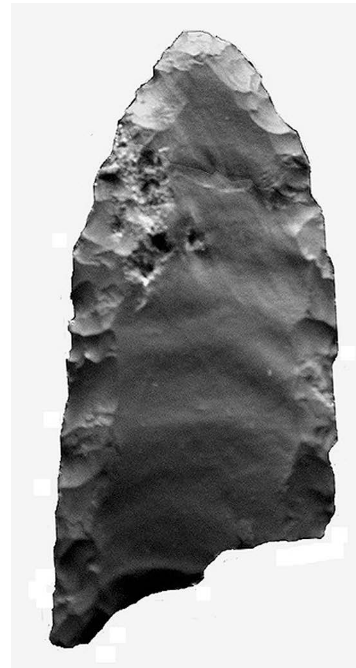
Points from the Upper and Lower Wheeler Dam sites, 8 km farther up the lake, are both deeply indented, Vail/Debert points (figure 5.5). The Adkins site is only about a kilometer from Vail. There are two fluted point bases from this site. One has a medium-depth basal indentation, and one has slight basal ears. If these points are contemporary with the Vail points, then they are at the edge of variation of the Vail/Debert modal point form. The Adkins point attributes (medium basal depth, slight ears) best match the attributes of the Bull Brook/West Athens Hill form.

The Morss site, 2.3 km northeast of the Vail site, has a couple of broken points and one reworked point. The reworked point base exhibits two moderate ears (figure 5.6). This point seems to fall within the Michaud/Neponset point form. One preform from the Morss site has a fluting scar that travels the length of the point, another attribute characteristic of the Michaud/Neponset form and not the Vail/Debert form.

Kill Site 2 has yielded two fluted points (Gramly 1984) (figure 5.7). One has a slight basal ear and channel flake



5.6. Morss site points



5.7. Vail area Kill Site 2 point

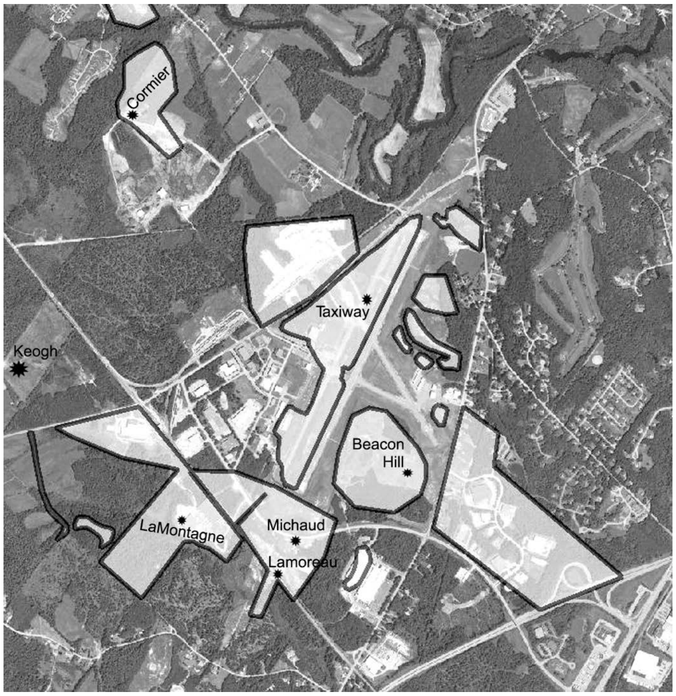
scars that travel the length of the point, attributes of the Michaud/Neponset point form. The other is a distal half, but it too exhibits channel flake scars that travel nearly the length of the point (Gramly 1984:119). Again, this point is probably a Michaud/Neponset point form. Even though Kill Site 2 is only 650 m from the Vail site, the point forms match those from the Morss site, 2.1 km away.

In summary, both Vail/Debert and Michaud/Neponset points are definitely present on sites in the Vail geographic cluster. Bull Brook points may be present at one site. The three closest habitation sites, Vail, Adkins, and Morss, exhibit different point forms. The other sites with Vail/Debert points are the Wheeler Dam sites, 8 km farther up the valley. Kill Site 2 has Michaud/Neponset type points, as does the Morss site. If Kill Site 2 and the Morss sites are related, then the distance between them (2.1 km southwest from Morss to Kill Site 2) provides another distance between kill and habitation site for temporally related sites. If Bradley et al. (2008) are correct about the radiocarbon dates assigned to these point styles, the Magalloway River valley remained an attractive place for Paleoindian groups for centuries, from perhaps 10,500–10,200 ^{14}C yr, or as much as 12,600–11,900 cal years, more or less coincident with much of the Younger Dryas climate event.

THE MICHAUD (AUBURN AIRPORT) GEOGRAPHIC CLUSTER

Turning our attention to the Auburn Airport located in central Maine, the Michaud site was discovered there about twenty-five years ago. A great deal of professional archaeological survey in the area, all in advance of development, located six habitation sites and one isolated artifact find spot. One other site was found by a collector and surface-collected in advance of sand and gravel quarry operations (figure 5.8). This is the first published report of some of these sites. Omitting the single artifact find spot, each of the seven sites is a habitation, camp, or work site with two or more concentrations of stone tools. The extent of professional survey in the Auburn Airport vicinity has produced a sense of archaeological site distribution similar to the exposure of sites on the eroded floor of Aziscohos Lake, around the Vail site. We know where sites are and where they are not in large areas around the airport.

In contrast to the Vail geographic cluster, no kill sites (localized, fluted point concentrations) have been located in the airport vicinity. However, one of the Michaud geographic cluster sites is a hilltop site with obvious advantages for observing the surrounding countryside in a minimally



5.8. Michaud, or Auburn Airport, geographic cluster. Light areas have been surveyed by professional archaeologists. The Keogh, Michaud, Taxiway, and Cormier sites have been completed excavated and are now destroyed. LaMontagne and Lamoreau site locations are approximate.

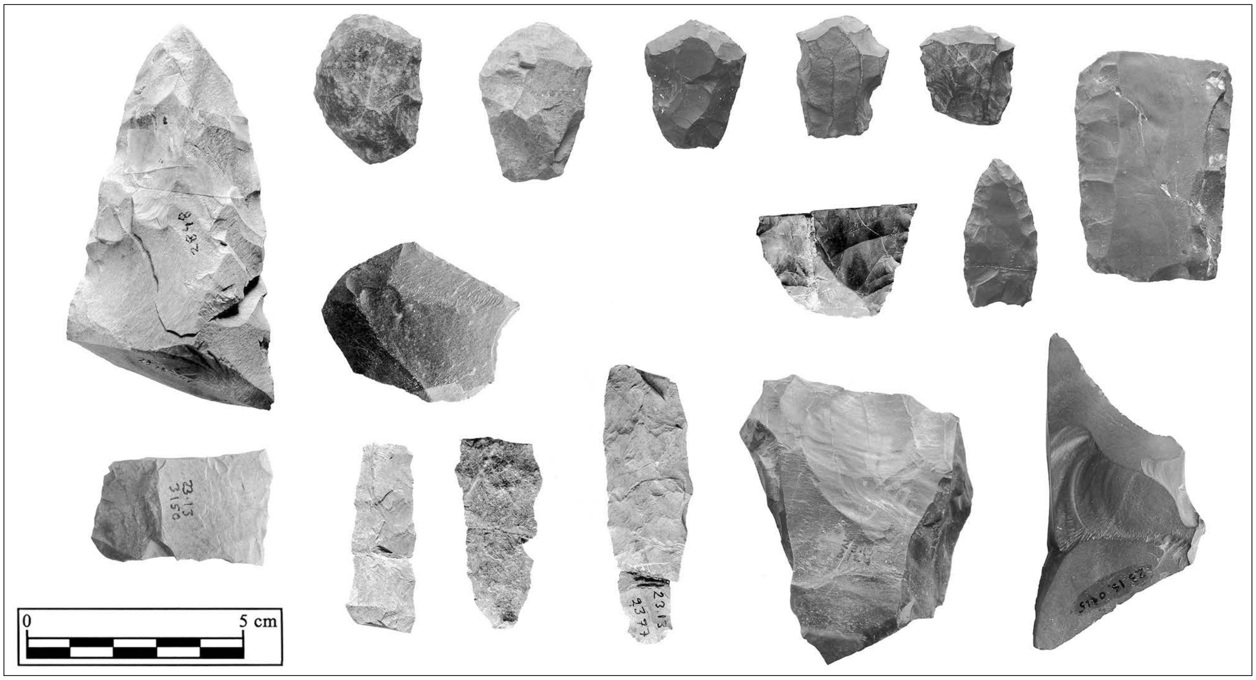
wooded environment. Most of the lithic raw materials found on these sites are easily identifiable to bedrock source, unlike the lithics in the Vail cluster. Therefore, we have the additional opportunity to look at variability of broad lithic procurement patterns with the Michaud sites.

The Michaud site was completely excavated in advance of road construction (Spiess and Wilson 1987). The fluted points recovered there are one basis for the Michaud/Neponset point form, with flaring ears and sometimes long channel flakes that extend the length of the point. The raw materials include Munsungun chert, Mount Jasper or Israel River rhyolite, and one or more Champlain or Hudson valley cherts.

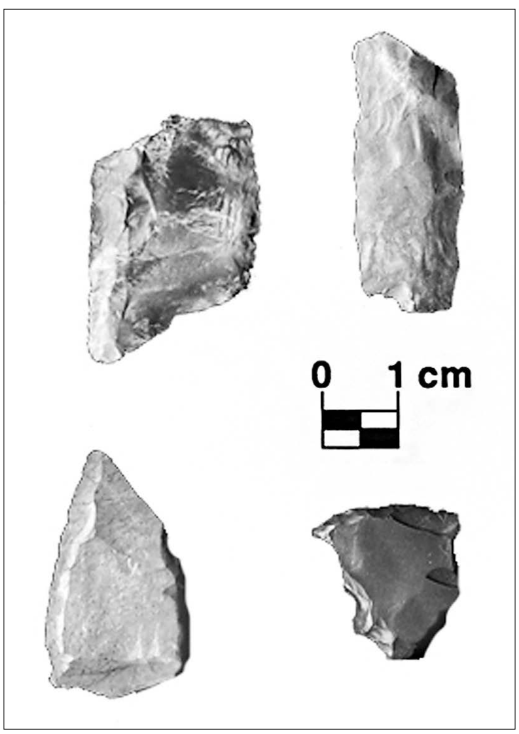
Located across Moose Brook from the Michaud site is the Lamoreau site (Spiess and Wilson 1987:125–128; two subsequent seasons of work unpublished). So far there are no finished or broken/discarded fluted points from this site. There is one broken preform and one miniature point (figure 5.9). Despite the absence of finished fluted point bases, there are many channel flake fragments, some of which refit into long channel flakes (made of Israel River rhyolite). There is also a ground tip from a fluted point preform. Ground tips and long channel flakes are markers for the Michaud/Neponset point form. The lithics are dominated by Munsungun chert and Israel River/Mount Jasper rhyolite. There seems to be much less use of Champlain/Hudson valley cherts at the Lamoreau site than at the Michaud site.

Cowie and Bartone and colleagues (Bartone et al. 2007; Brigham et al. 2009; Gammon and Bartone 2007) are responsible for discovering three other sites at the airport and in an associated industrial park and recording one found by a collector in a sand blowout. The LaMontagne site is on a geographic landform similar to that at the Lamoreau site near the south bank of Moose Brook. One fluted point base has been recovered (figure 5.10). The point lacks a basal ear on the one preserved lateral edge and has straight sides, a moderately deep base, and a moderate to long channel flake scar. In addition, there are relatively long channel flake fragments from the site. The point from the LaMontagne site falls within the attribute range of the Bull Brook/West Athens Hill form. The raw materials from this site are mostly Munsungun cherts, but there is Pennsylvania jasper as well.

The Taxiway site was found next to the northern airport runway during testing for construction of a new aircraft taxiway (figure 5.11). This site has six or more concentrations of stone tools, depending on how we count them. The one recognizable fluted point is a Michaud/Neponset point with a large basal ear on the right side and long channel



5.9. Lamoreau site artifacts: broken fluted point preform (upper right) and long channel flakes (bottom center).

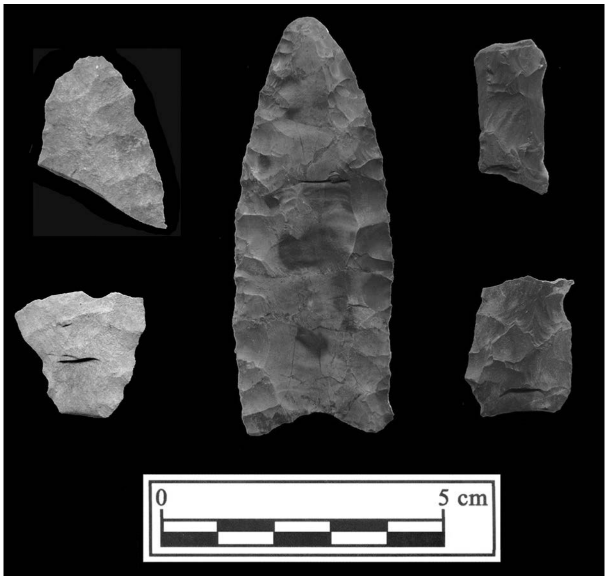


5.10. LaMontagne site artifacts, including fluted point base with one broken ear (upper left).

5.11. Taxiway site under excavation, Auburn airport.

flakes (figure 5.12, center). The dominant raw material at the Taxiway site is Mount Jasper/Israel River rhyolite, with Munsungun chert being a close second in frequency. Crystal quartz is also common. And there are some odd cherts, including a brick-red material that we have rarely seen in other Paleoindian sites in Maine.

Overlooking the airport is a bedrock hill with the flashing airport beacon on top. Here there is a Paleoindian site with two stone tool concentrations (Beacon Hill site). This was probably an overlook and workshop site, with visibility for miles around. A discarded, reworked fluted point from the Beacon Hill site is clearly a Michaud/Neponset point

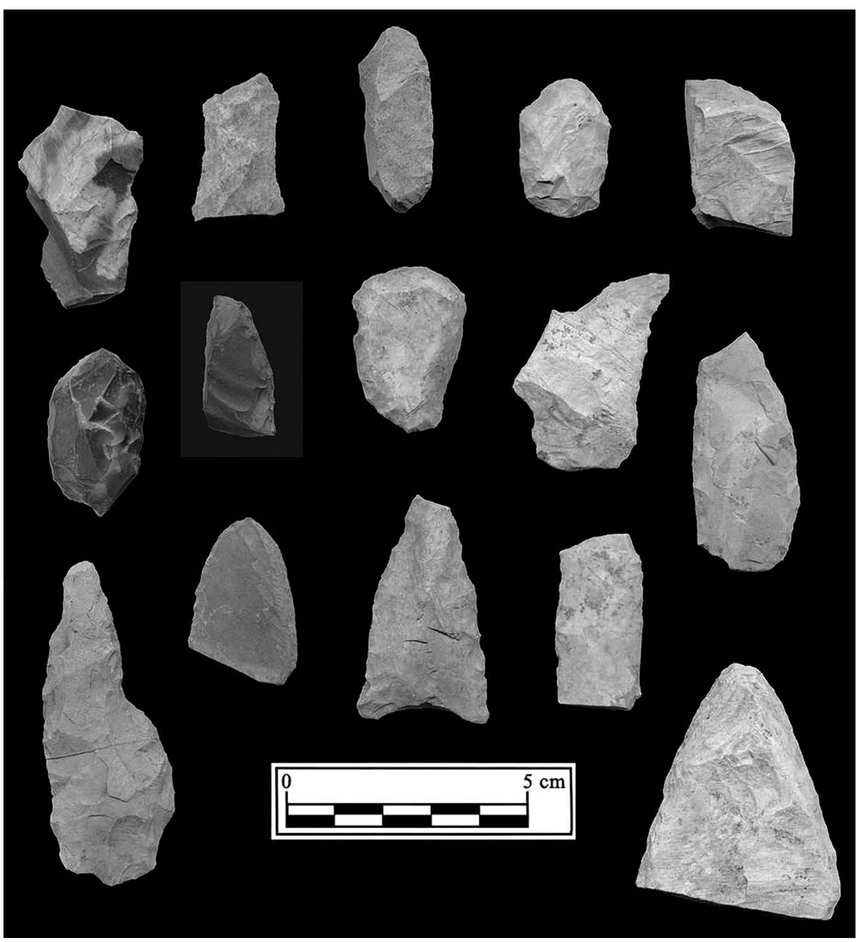


5.12. Taxiway site point (center), biface fragments (left), and channel flakes (right).

(figure 5.13). Mount Jasper/Israel River rhyolite is by far the most common raw material, with Munsungun chert being a distant second in frequency.

A site was found in a sand blowout about a kilometer west of the airport by a Mr. Keogh, who had the presence of mind to collect all the lithic material on the surface (Keogh site) and report the site during the Taxiway site excavation. The collection includes one broken or reworked Michaud/Neponset point base made of beautiful Munsungun chert (figure 5.14), a range of other cherts, and Mount Jasper/Israel River rhyolite.

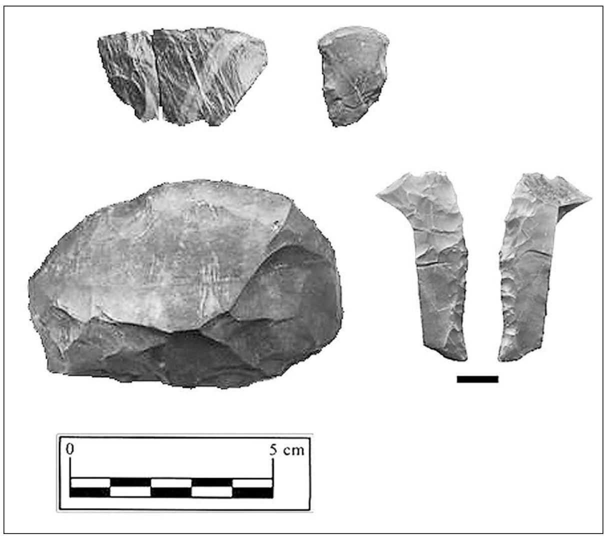
The Cormier site, located on the sandy slope of a hill about a kilometer northwest of the airport, was excavated by Richard Will and colleagues (Moore and Will 1998). The points from the site (figure 5.15) are one holotype of the Cormier/Nicholas point form, which is stylistically equivalent to the points from the Holcombe site in the Great Lakes. The artifacts at the Cormier site are dominated by Mount Jasper/Israel river rhyolite. Munsungun chert



5.13. Beacon Hill site artifacts. Fluted point just above scale.

is the second most common raw material, but less than 20 percent in frequency. There are other cherts, including a couple of pieces of Champlain or Hudson valley chert. There are three larger reworked chert points in the Cormier assemblage that are larger and thicker than the rest of the points from the site, with remnant long channel flakes. All the points are made of Mount Jasper/Israel river rhyolite, with the exception of these three larger points. We suspect that they were scavenged from the Michaud and related sites around the airport and used by the later Cormier site inhabitants.

In summary, the lithic material from the Michaud, or Auburn Airport, geographic cluster is dominated by Munsungun chert and Mount Jasper/Israel River rhyolite. One or the other of these two materials is more common and obviously the most recent lithic resupply, but it varies from site to site. Additionally, there are lesser amounts of Hudson Valley or Champlain Valley chert and minor other materials including crystal quartz, indicating that these people were not just going north to Munsungun and southwest to Jefferson, New Hampshire. Thus, we see that use of one local geographic area was not part of a regular round of visits to these quarry locations. The sequence of visiting the quarries varied from site to site, a conclusion we reached when examining lithic variation among artifact concentrations within the Michaud site (Spiess and Wilson 1989).



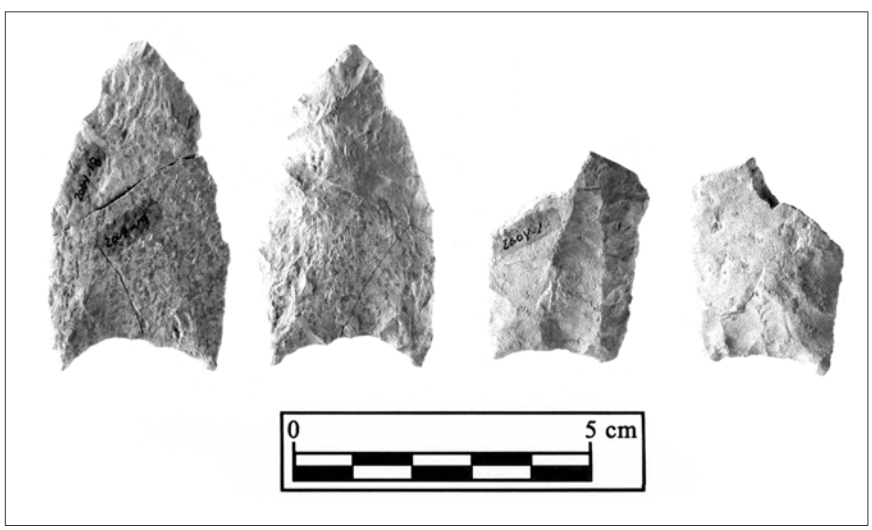
5.14. Some of the larger Keogh site artifacts. Obverse and reverse of broken fluted point at right.

Most of the sites around the Auburn Airport have Michaud/Neponset points, except the Cormier site about a kilometer farther up the Moose Brook drainage. It is probable that the LaMontagne site point is a Bull Brook/West Athens Hill form. Like the Vail site area, the Auburn Airport geographic area was attractive for a span of time that overlapped the manufacture of two or three Paleoindian point forms, a chronological span of a couple of centuries to as much as 500 calendar years.

DISCUSSION

We have learned that the Vail and Michaud geographic clusters of Paleoindian sites were formed by reuse of each area over hundreds of years. It is also probable that use of these

5.15. Two Cormier site fluted points, obverse and reverse.



two clusters overlapped in time, during the manufacture of Bull Brook/West Athens Hill and Michaud/Neponset point forms. The use of the Vail cluster apparently began and ended earlier than at the Michaud geographic cluster. Use of the Michaud cluster extended into the time of manufacture of Cormier/Nicholas points at the end of the Younger Dryas. We have also learned that the lithic materials brought to the sites in the Michaud cluster are variable from site to site, although two materials dominate (Munsungun chert from the north and Israel River/Mount Jasper rhyolite from the southwest). Thus, the multiple sites in the Vail and Michaud geographic groups do not reflect simple repetition of the same behavior over a short period of time. We will have to look more closely at the site location and environmental reconstructions to figure out why.

We suspect that each area remained a useful seasonal geographic focus for caribou hunting over centuries during the Younger Dryas. We also suspect that very localized changes in vegetation cover over a time scale of decades caused people to shift their camping or working locations on the scale of hundreds of meters with each geographic area reuse. Whereas the multiple concentrations or activity loci in what we call one Paleoindian archaeological site represent very limited or contemporaneous occupation, the multiple sites in geographic clusters represent measurably longer time scales.

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Part II
Specialized Studies

CHAPTER VI

New Sites and Lingering Questions at the Debert and Belmont Sites, Nova Scotia

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More than forty years ago the Debert site excavations signaled a new standard for interdisciplinary approaches to the investigation of late Pleistocene archaeological sites. The resulting excavations produced a record that continues to anchor northeastern Paleoindian sites (MacDonald 1968). The Confederacy of Mainland Mi'kmaq (the Confederacy) has been increasingly involved with the protection and management of the site complex since the discovery of the Belmont I and II sites in the late 1980s (Bernard et al. 2011; Julien et al. 2008).[1] The data reported here are the result of archaeological testing associated with these protection efforts, the development of the Mi'kmawey Debert Cultural Centre (MDCC), and the passage of new provincial regulations solely dedicated to protecting archaeological sites in the Debert and Belmont area.[2] These surveys have expanded the extent of the Hunter Road site, identifying eight new locales within 500 m of the original Debert and Belmont sites and two additional locales approximately one kilometer south of the complex (Buchanan 2007, 2008). The site complex is now more than 100 ha. Equally important, geological and pedological research are enhancing our understanding of the sites' relationship to regional stratigraphy and correlating climatic chronozones (Brewster 2006; Stea 2006, 2009a, 2009b). This chapter presents a model for the depositional history of the site area, including two divergent scenarios for the origins of the cultural materials at the sites. We believe the expanded areal extent of the complex, the nature of past excavations, and the degree of site preservation place the Debert-Belmont complex among the largest, best-documented, and most intact Paleoindian sites in North America.

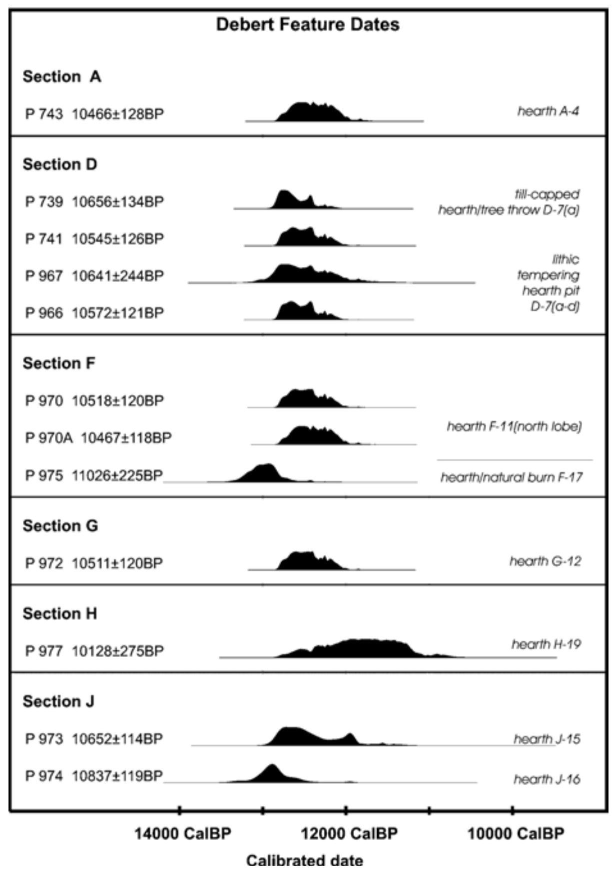
The new finds and recent research have resolved some long-standing issues, but they have also created new debates. Understanding the relative chronologies of the numerous site areas and the consequent relationship among the sites requires not only understanding depositional contexts for single occupations but tying together varied contexts (redeposited, disturbed, glaciofluvial, glaciolacustrine, Holocene fluvial) into an integrated depositional model. MacDonald's (1968) site monograph has enjoyed widespread acceptance and use across the discipline for several decades. Since the discovery of the Belmont sites, however, questions concerning the depositional origins of late glacial sediments and the relationships among the cultural materials, organics, and stratigraphic contexts at the Debert site have intensified (Bonnichsen and Will 1999:405–407; Bonnichsen et al. 1991:17; Brewster et al. 1996:86; Davis 1991:51–53, 2011; Stea 2011). One of the most important of these issues is the dep-

ositional origin of the unstructured and laminated sands, what we call the *cover sands.* The unit we identify as the cover sands includes poorly sorted massive sand, (finely) laminated sands, (thickly) stratified sands, cryptically bedded sand, and pedogenically altered (including bioturbation) sand facies. Sites are encountered regularly within this full range of depositional contexts of the cover sands. Artifacts have now been found within the strata identified by MacDonald (1968:6) as the structured/laminated sands. Additionally significant are the spatial integrity of cultural materials, organics, and their stratigraphic contexts and the conflicts between the radiocarbon dates from the Debert site and regional paleoenvironmental and chronological data. In this chapter we present a new depositional model for the cover sands and develop two scenarios that account for the points of agreement and disagreement among us on the spatial integrity of the sites and conflicts in dating.

DEBERT-BELMONT: A REMARKABLE SITE COMPLEX

Revealing one of the largest Paleoindian sites in North America at the time, the Debert excavations identified numerous loci with large quantities of varied diagnostic tools and debitage and multiple hearth and pit features. The tool assemblage is one of the largest in eastern North America, with more than 4,600 formal tools and 23,000 pieces of debitage, including 140 fluted points (Ellis 2004; MacDonald 1968; Robinson et al. 2009:428). The broad range of formal tools represents a full suite of domestic, manufacturing, resource procurement, and processing activities associated with a combined site area in excess of 19,000 m^2.[3] The publication of MacDonald's (1968) site monograph and related articles (Borns 1966; Byers 1966; MacDonald 1966; Stuckenrath 1966) established Debert as a hallmark of interdisciplinary research in the region. The legacy of the site has provided crucial baseline data for a wide range of subsequent research investigating the nature and extent of settlement and social aggregation (e.g., Dincauze 1993; Robinson et al. 2009), lithic analyses (e.g., Ellis 2004), comparative site analyses (e.g., Davis 1991), and correlating paleoenvironmental records (e.g., Newby et al. 2005).

Climatologically, the work advanced the understanding of late Pleistocene climate change in the Canadian Maritimes (Borns 1965). Charcoal samples produced thirteen radiocarbon dates with solid associations to these presumed cultural features—bracketing the millennia now largely defined by the Younger Dryas cooling event (Mayle et al. 1993; Mott, Grant, Stea, and Occhietti 1986). Despite some questions about the context of these dates (Bonnichsen and Will 1999:405–407; Bonnichsen et al. 1991:17; Brewster et al. 1996:86; Davis 1991:51–53, 2011; Stea 2011), they remain the largest number of widely accepted radiocarbon dates of this age in Canada and the northeastern United States (Curran 1999; Ellis 2004:242–243; Robinson et al. 2009:424). Further, although we understand that many people, over many years, have averaged the Debert dates, we do not see any reason for this. Indeed Debert is often singled out as the only solidly dated late glacial site in the Far Northeast (figure 6.1, table 6.1) (e.g., Newby et al.



6.1. Calibrated radiocarbon dates for features from the Debert site after MacDonald (1968: 24–27, 54–56) in table form and shown as a plot. Tabular dates calibrated using CALIB version 6.0.1, calibration dataset intcal09.14C; plot using atmospheric data from Reimer et al (2004), OxCal v3.10 Bronk Ramsey (2005), cub r:4, sd:12 prob usp(chron).

Table 6.1. Dates for Features from the Debert Site

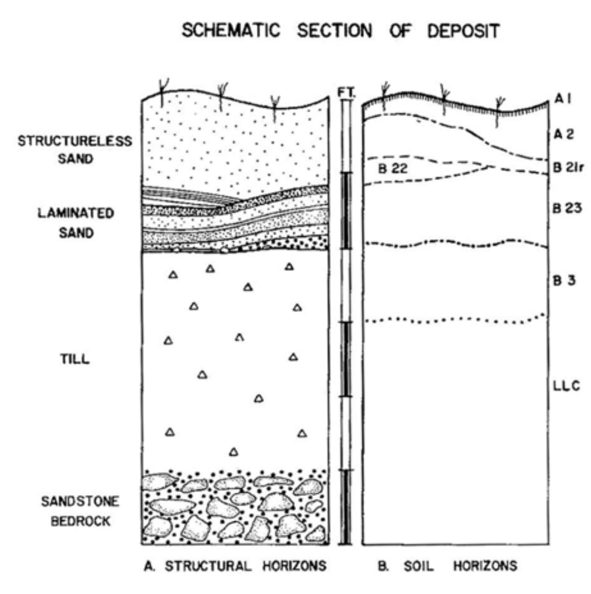
Feature	*Section*	*Sample Number*	*Date ^{14}C BP*	*Calibrated Age cal BP (2σ)*
4	A	P743	10,466 ± 128	11,972–12,638
7A	D	P739	10,656 ± 134	12,135–12,848
7	D	P741	10,545 ± 126	12,063–12,677
7	D	P967	10,641 ± 244	11,760–13,099
7	D	P966	10,572 ± 121	12,093–12,690
11	F	P970	10,518 ± 120	12,056–12,651
11	F	P970A	10,467 ± 118	11,998–12,617
11	F	P971	10,773 ± 226	12,061–13,153
17	F	P975	11,026 ± 225	12,549–13,348
12	G	P972	10,511 ± 120	12,049–12,647
19	H	P977	10,128 ± 275	11,076–12,596
15	J	P973	10,652 ± 114	12,370–12,796
16	J	P974	10,837 ± 119	13,011–13,065

After MacDonald (1968:24–27, 54–56).
Calibrated using CALIB version 6.0.1, calibration data set intcal09.14C.

2005:150; Spiess et al. 1998:236; although now see Robinson et al. 2009:425).

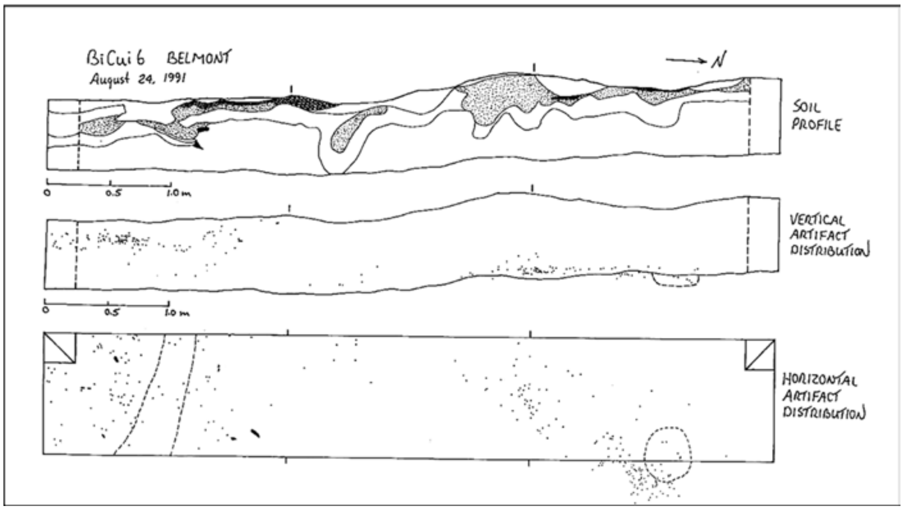
The geologists and soil scientists working with MacDonald defined the depositional and environmental contexts of the Debert site, situating it chronologically and spatially more securely than most other sites had been to date (Borns 1966; Lyford 1964; Swift 1965). MacDonald identified three major sediment facies above the Triassic bedrock: till, laminated sands, and structureless sand (figure 6.2). The site's stratigraphy was considered to be relatively simple, with artifacts found solely in the structureless sand facies (MacDonald 1968:6). MacDonald argued that the structureless sand was the "organic working of the underlying structured sands," which were eolian in origin. He (1968:18) documented the removal of surficial material (up to 30 cm in some cases) and demonstrated (1968:11) that there was no correlation between soil horizons and strata containing cultural materials. Current LIDAR analyses estimate that at least one meter of material was removed from portions of the site surface (Stea 2009b:18). This stratigraphic information is the foundation for subsequent discussions in this chapter.

The Debert site was designated a National Historic Site of Canada in 1972 and a Nova Scotia Special Place in 1974. The boundaries of the Nova Scotia Special Place significantly exceeded the land area of the original Debert site, and as the landowner the province chose to establish

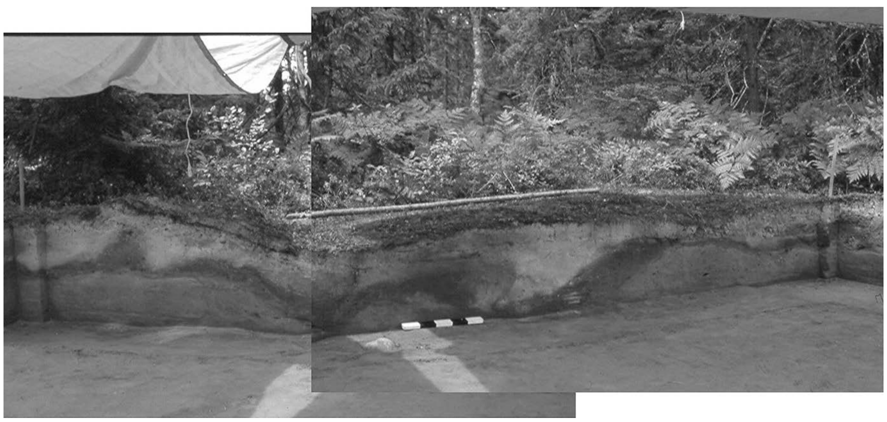


6.2. Schematic section of the Debert deposit: A, structural horizons; B, soil horizons (MacDonald 1968:Figure 4).

a silviculture seed orchard for operation within the limits of the Special Place beyond the known boundaries of the Debert site. As a consequence, it was nursery staff who found the "Belmont" sites between 1989 and 1991, resulting in Davis's three seasons of selective survey, test excavations, and additional geological and pedological investigations (Brewster et al. 1996; Davis 1991, 1993).



6.3. Original field profiles and plan view of the 1 m by 6 m unit excavated at the Belmont I site.



6.4. Belmont II 2 m by 6 m unit showing profiles to the level of the presumed living floor (photographs courtesy of Gordon Brewster).

Belmont I and Ia

Clearing operations in 1989 exposed a small collection of artifacts in the far northeast corner of the seed nursery, including a spurred endscraper, chalcedony flakes, and possible cobble tools made of porphyritic rhyolite—consistent with raw materials from the Debert assemblage. Sixteen discrete artifact scatters and additional isolated finds were reported over roughly 20,000 m^2 during subsequent surface reconnaissance (Davis 1993). Artifact forms are consistent with the Debert site, including sidescrapers and endscrapers, spurred endscrapers, retouched flakes, bifaces, and rough bifacial choppers.

Positive test results in proximity to dense lithic scatters in the northern portion of a survey tract led to one of the most significant finds of the Belmont fieldwork. A 1 m by 6 m excavation unit recovered more than 300 microflakes from direct and general associations with a small basin-shaped pit feature with charcoal (figure 6.3). Unfortunately, the charcoal sample is not available for dating. A small scatter of flakes and tools, designated Belmont Ia, was identified during the 1991 fieldwork, within recent forestry operations on a raised terrace about 100 m southeast of the main Belmont I finds.

Belmont II and IIa

Artifacts were exposed in a bulldozer cut over the edges of a small side terrace 200 m southwest of the Belmont I site. Upwards of 100 artifacts were recovered from surface reconnaissance in the surrounding area, which is located below a prominent glacial scarp cutting along the west edge of the upper Belmont terraced ridge topography. An initial 1 m by 6 m excavation unit at Belmont II was expanded to 2 m by 6 m over a dense occupational surface, producing more than 700 artifacts beginning 75 cm below near-surface disturbance (figure 6.4). The assemblage includes a large number of flakes, a fluted point preform, and an assortment of

scrapers and gravers. Two small concentrations of flakes and tools, designated Belmont IIa, were also identified in soil exposures of the road cut along the upper edge of the scarp. Despite the dense concentration of occupational remains, no datable associations or samples were reported.

Stea and Brewster became directly involved with the Belmont sites during the testing and investigations of the Belmont I/Ia, Belmont II/IIa, and Hunter Road sites in 1989 and 1990. At the time, they argued (Brewster et al. 1996:85–86) that the sands associated with the Belmont II site were likely to be lacustrine in origin rather than eolian. We expand this argument below, demonstrating that the cover sands are most likely a Younger Dryas glaciofluvial/glaciolacustrine deposit.

Hunter Road and an Isolated Find

The Hunter Road site, identified by nursery staff in 1989, is on a small knoll 600 m southeast of the Debert site. The main distribution of artifacts was found in disturbed sediments on the south-facing slope of the knoll. Two small test pits excavated along the south edge of the road in 1990 did not encounter further materials. The extent and integrity of this small site were undetermined, and the site was believed to have been largely impacted by forestry activity.

A chalcedony flake scraper was recovered from one of two small plantation plots under preparation between the Hunter Road site and Belmont I and II in 1989. Multiple conflicting documented and anecdotal reports are associated with this find, leading some to believe that there was more than one find.

MI'KMAW PRIORITIES AND OUTCOMES

At the time that Donald M. Julien, executive director of the Confederacy, was invited to visit the Belmont sites in 1989, there was little to no active protection of the sites, nor had there been any First Nations involvement to date (figure 6.5). Working with the province, the Confederacy began a series of activities to protect the sites, including increased signage and monitoring. In 2001 work to halt organized motocross activity was successful, in part due to the hefty $100,000 potential fine to the organizers. However, recreational use of the sites continues to present challenges despite new signage, monitoring, and public education efforts. By 2005, industry in the Debert area was intensifying after more than twenty-five years of planning and expansion by the province. This industrial development had proceeded with limited archaeological testing in some instances, none of which identified any archaeological resources.

Initially unrelated to this industrial development, in 2002 an "Umbrella Agreement" confirmed the intent of the Government of Canada, the Province of Nova Scotia, and the Mi'kmaw Nation to enter into a renewed treaty rights negotiation process.[4] Due in large part to intense interest in developing land adjacent to the sites as well as in transferring lands in control of the provincial government to the County of Colchester as part of this development, the Nation selected the Debert lands as a pilot project for the treaty rights process (figure 6.6). It was through this process that an intensive multiyear survey to identify the

6.5. Roofing shingles dumped at the original MacDonald site, March 2006. Also note ATV tracks at upper right (photograph by Sharon Farrell, CMM).

6.6. Elder Douglas Knockwood and executive director Donald Julien visiting the potential location for the Mi'kmawey Debert Cultural Centre, December 2008 (photograph courtesy of Tim Bernard, CMM).

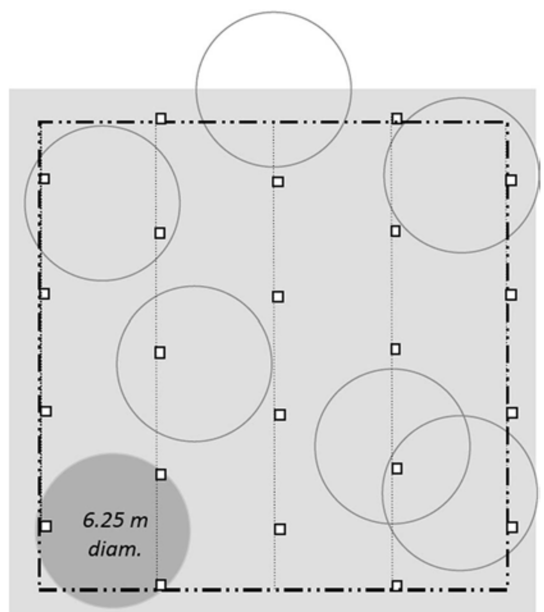
boundaries of the known sites was initiated (the Debert Site Delineation Project) and that the Debert Archaeological Resource Impact Assessment Regulations (R.S.N.S. 1989, c. 438, O.I.C. 2008–170, N.S. Reg. 129/2008) were passed in 2008.

The Site Delineation Project, the new Debert regulations, and the development of the Mi'kmawey Debert Cultural Centre are responsible for all of the site finds within the Nova Scotia Special Place as well as the production of geological, pedological, and other research work related to the sites (Bernard et al. 2011; Brewster 2006; Buchanan 2007, 2008; Julien et al. 2008; Stea 2006, 2009a, 2009b; Stea and Whiteley 2005). Although the funds secured have been primarily targeted for resource protection and management rather than research-driven agendas, there is considerable research value to these activities. In all, more than C$1.2 million has been leveraged to test and protect the area, including mapping and related analyses.

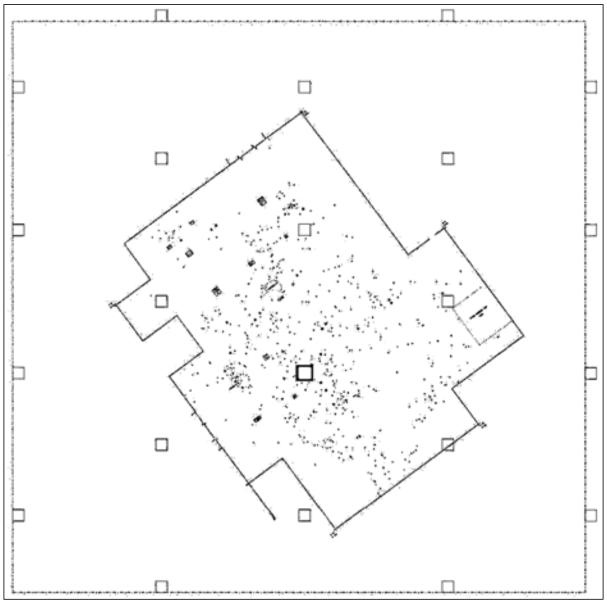
NEW SITES: METHODS AND RESULTS

Since the fall of 2006, the Debert Site Delineation Project has systematically surveyed a 50 m wide perimeter band around buffer zones established for the Debert and Belmont I and II sites as well as a 100 m radius around the Hunter Road lithic scatter and two reported find spots. The testing strategy defined here also served as the basis for the testing strategy in the new Debert regulations and for testing at the planned cultural center site.[5] The buffers to be tested were established by mapping all available data from preexisting (available) testing and excavation units and surface collections from the Debert, Belmont, and Hunter Road investigations. Given the goal to establish field-truthed buffer zones around the site areas, the two prominent site clusters at Belmont I and II were treated as a single management unit. The main Debert site and the northern locus of Section 1 define a second large survey tract. A 100 m radius was systematically surveyed around isolated find spots and scatters. The Site Delineation Project utilizes a systematic shovel test survey applied to a checkerboard grid of alternating 20 m survey squares within the delineation perimeters. The method implements a half-interval staggered transect spacing of twenty-two tests per 20 m survey square (figure 6.7). Any new finds require supplemental testing to redefine expanded buffer zones, effectively delineating a perimeter free of cultural resources around the sites. At the time of this writing, approximately 63 percent of these buffer zones had been tested.

Comparisons with artifact frequency and distribution patterns from the Debert site using Kintigh's (1988) sampling simulation module reveal differential trends in the probability of intersecting individual features and section. The prospects for detecting the principal site areas (i.e., living floors) at the Debert site are excellent, whereas smaller individual features themselves are elusive targets. Soft modeling the survey design against real patterns from the Debert excavations highlights the potential significance of limited artifact counts from a single test unit in Section C (figure 6.8). When several positive tests were found proximate to land about to be transferred to the county for development, one testing area was doubled to provide a continuous 5 m test pit interval. No additional finds were documented through a second round of testing the alternate perimeter survey squares within a 100 m radius of the initial finds. This demonstrated that, even



6.7. Debert Site Delineation Project 20 m by 20 m unit with test pits staggered every 5 m. Circles indicate the hypothesized intersections with a minimum 6.25 m diameter site. The strategy detects sites of this size with a minimum 80 percent certainty on the basis of a single artifact find.



6.8. Debert Site Delineation Project 20 m grid square with staggered shovel tests (shadow squares) overlain on Section C of the original MacDonald site, illustrating the potential significance of limited survey results within a dense occupation surface. Although the original section produced more than 600 formal and expedient tools and 3,208 flakes from 98 m^2 as well as three features, there is only one positive test unit (dark square) with six artifacts in this scenario.

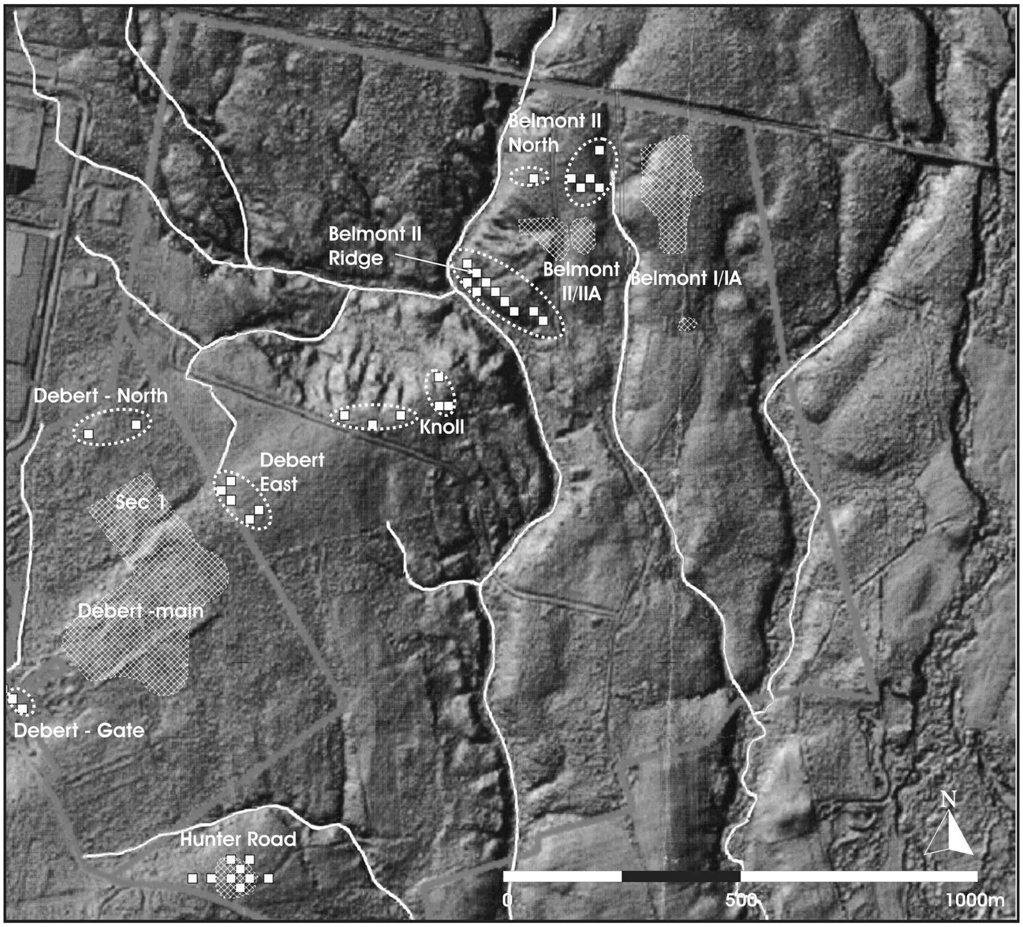
though a small number of artifacts can indicate a relatively large occupation (i.e., Section C example above), these results offer encouraging prospects for reliably detecting small sites.

The testing strategy employed through the Debert Site Delineation project, the new Debert regulations, and the testing for the cultural center has identified ten new site areas within a substantially expanded site complex and two new sites on adjacent industrial lands, and they have refined the perspective on the Hunter Road site as outlined below (figures 6.9 and 6.10):

- expanded extent and defined contexts at the Hunter Road site
- three new sites within the Debert survey perimeter (Debert-North, Debert-East, and Debert-Gate)
- two new sites on the margins of the upper Belmont II terrace (Belmont II North)
- one new site in a raised sandy ridge at edge of a channel cut, southwest of Belmont IIa (Belmont II Ridge)
- split flake scatter of two loci on the 'knoll," a central position between Belmont II and the main Debert site (Knoll)
- two new sites on industrial lands about one kilometer south of the Debert site

To date, more than 6,900 shovel tests have been systematically excavated for site management surveys directly within the Debert-Belmont site complex and upwards of 14 ha have been surveyed on the adjacent industrial lands (Laird Niven, personal communication, January 2010). Despite the significantly broader extent of early site locations and range of landforms and elevations, several coordinating patterns are evident in the distribution of the Debert-Belmont sites. There is an overall consistency of site locations, directly above topographic breaks adjacent to the margins of late glacial landforms and drainage features in varied depositional modes of late glacial cover sands. Site locations associate strongly with four late glacial topographic and geological contexts: (1) the upper terrace and edges of the Belmont sites; (2) the margins of a distinct and complex late glacial drainage basin and downcut channel framed by the lower terrace alluvial fan and levee of the Belmont II sites and the northeastern section of the knoll site; (3) the margins of a meltwater channel framed by the Debert ridge and the opposing stepped gradient of Section 1 of the

6.9. Selected artifacts found in the Debert Site Delineation Project survey testing: top left, chert scraper; top right, utilized flake; bottom left, flake; bottom right, fragment of a uniface.



6.10. LIDAR relief base map showing locations of 20 m survey squares. The shading for preexisting sites (Debert, Belmont I and II, and Hunter Road) shows extent of excavation or surface finds related to each site area (i.e., these are not occupation areas per se) (LIDAR base image courtesy of Tim Webster, College of Geographic Sciences, Lawrencetown, Nova Scotia).

Debert site; and (4) the margins of a low-gradient ridge extending along MacElmon Road between the Hunter Road and TCH 104 (Exit 13) site locations.

TOWARD AN INTEGRATED DEPOSITIONAL MODEL

The new site data from the Debert and Belmont complex continue to be processed and analyzed, and it is clear that the varied depositional contexts and topographic associations of the site complex require an integrated depositional model. The large number of loci and sites now identified requires not only understanding depositional processes for a single loci or site but tying together multiple and varied stratigraphic contexts into an overall integrated depositional history for the entire site area. Without integrating these depositional contexts we will be unable to assess the relationships among the sites or to understand the significance of the context for each site individually. The site descriptions above demonstrate a variety of stratigraphic contexts for artifacts as well: Holocene fluvial deposits with late glacial sediments redeposited; in situ glacial deposits including glaciofluvial and glaciolacustrine; and modern disturbance of both late glacial and Holocene deposits of various kinds. There is no single stratigraphic context or depositional origin for the sediments of the various sites. An integrated depositional history of the sites, however, should be possible.

The research group agrees universally with Stea's (2011) interpretation of a Younger Dryas glaciofluvial and glaciolacustrine origin for the cover sands. This is most critical for its temporal implications, but it is also important because

new artifacts have been found within the upper homogenized zone as well as within the laminated sands. We diverge, however, on how to account for the presence of the cultural materials within the cover sands. We present two scenarios to allow for this divergence. One scenario posits that the cultural materials are late Allerød occupations that have been redeposited through Younger Dryas depositional events. The second asserts that the site complex area was occupied, and in all likelihood reoccupied, at numerous locales during the Younger Dryas, with the deposition of sediments before and after human occupations, with the archaeological contexts largely intact.

Each scenario accounts for the now wide range of stratigraphic and topographic contexts of the cultural materials, and each depends on primary assumptions that include the degree of integrity (or lack thereof) of the features and other spatial patterns of the sites, the degree of disturbance (or lack thereof) associated with Younger Dryas depositional events, the acceptance or rejection of the radiocarbon dates from the original Debert site, and the suitability of the Debert-Belmont area for habitation during the Younger Dryas.

The question of the origins of the cover sands has dominated much discussion among us over the past seven years—for it is these strata that hold the keys to resolving the depositional context, temporal occupation, and relative occupation of the various sites. The data reported here are largely derived from five reports—four geological (Stea 2006, 2009a, 2009b; Stea and Whiteley 2005), one pedological (Brewster 2006)—and the extensive data compiled by the Debert Site Delineation Project.[6] The evidence that the cover sands are the result of localized glaciation during the Younger Dryas comes from stratigraphic data at the sites, including records of soil formation (Brewster 2006, 2011), and from extensive research of the late glacial climate record including geological, palynological, and Coleoptera analysis throughout Nova Scotia and southeastern New Brunswick (Frappier 1996; Miller and Elias 2000; Mott 1994; Mott and Stea 1993; Mott, Grant, Stea, and Occhietti 1986; Mott, Matthews, Grant, and Beke 1986; Stea and Mott 1998). The concept of a glacial readvance during the Younger Dryas in Nova Scotia (i.e., Valders glaciation) was suggested by Livingstone (1968) and also by Borns (1966). Recent discoveries of glacial sediment burying Allerød paleosols across the province have reinforced the concept (Mott and Stea 1993; Stea and Mott 2005) with evidence of greater glaciation than first envisioned.

Our model holds that the cover sands are the result of deposition during the Younger Dryas and that there is no difference in the depositional origin of MacDonald's structureless and laminated sands. A 2006 geological survey was designed to determine the genesis and extent of the cover sands within the site complex (along with other sediments and soils) (figure 6.11). An 80 m interval augering survey, conducted by Stea and augmented by backhoe units in key areas, identified the extent and origins of the cover sands. For further details on methodology, see Stea (2006). Significant variation in the localized presence and relative expression of the cover sands has been identified as directly conditioned by factors of slope and elevation. The intensive archaeological survey at 5 m intervals within the site area has further refined our understanding of the variable presence of cover sands. The stratigraphic records of more than 6,900 shovel test profiles offer detailed perspectives of both subtle and significant variation in the relative definition of massive versus laminated sands and their distribution over considerably varied site environs.

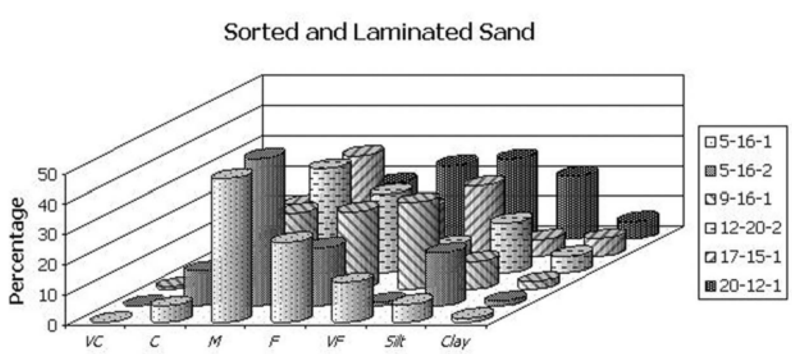
The two most important conclusions from these data are that the cover sands are not ubiquitous across the site

6.11. Map of the 2006 Debert geological augering survey.

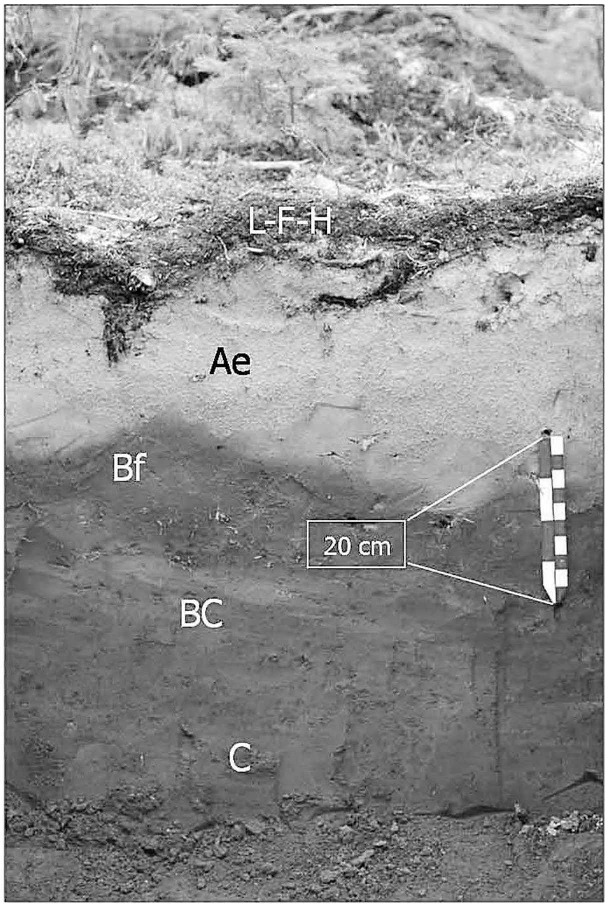
complex and that the presence and depth of the cover sands are directly related to elevation. Lower elevations, such as the original Debert site, have the thickest deposits (>2 m); higher elevations have only thin lenses or none at all, as with areas of Belmont I and Belmont II North. The cover sands are thinly deposited, if at all, above 35 m elevation within the site complex. Stratigraphically, the cover sands extend below well-developed Holocene soils in some auger sites—something verified by the numerous units of the Site Delineation Project. This stratigraphic sequence indicates that the sands were deposited well before the onset of the formation of the Holocene soil. These characteristics along with the restricted distribution favor a lake or pond origin (Stea 2011:66); the first conditions to create a pond or lake prior to the onset of Holocene soil formation were the Younger Dryas. Thus, even without direct radiocarbon dates, the geological data from the sites indicate that the cover sands are a Younger Dryas glaciofluvial and glaciolacustrine deposit. Many drainage features originated during the Younger Dryas, and there are clear indications of localized glacial damming and ponding (Stea 2006, 2009a).

In addition to the evidence demonstrating that the cover sands were glaciolacustrine and glaciofluvial in origin is evidence from the soil analyses that the sorted and laminated sands are not eolian in origin as argued by MacDonald (1968:6). In an analysis of six geological auger sites, the varied size distributions both within and among units demonstrate that the deposits are not eolian in origin (figure 6.12). It is impossible to understand the depositional history of the sites and this stratigraphic data without integrating a thorough understanding of soil formation processes, something we find unevenly considered across the literature. Soils are formed not from the surface up in an accretive process but from the surface down, largely through five factors: temperature, precipitation, organisms, topography, and parent material. Writing about the Debert soils, Brewster (2011:23–24) explains:

> Soils form over time and, in the case of the Debert-Belmont sites, the time period is very long, say 10,500 ^{14}C yrs BP. . . . Some of these soil cycles are extremely long, perhaps operating over millennia (mineral weathering for example), other soil cycles are very short, perhaps operating over months (organic matter dynamics) or years, decades or centuries (horizonization). . . . Also during the 10,500 ^{14}C yrs BP or so of soil formation, there occurred processes that tended to create differentiated soil horizons (anisotropic/complex soil profiles), a process generally called horizonization. This was countered by various processes which tend to mix the soil and soil horizons (isotropic/simple profiles), a process known as haploidization. . . . It is important to realize that the major "drivers" for these processes, horizonization and haploidization, have greatly changed over time as the soil-forming factors themselves have changed (for example, tree throw processes and freeze-thaw/cryoturbation processes), some being more intense/dominant at specific combinations of climate and vegetation.



6.12. Size distribution histograms for selected samples of the sorted and laminated sand deposits. VC, very coarse sand (2.0–1.0 mm); C, coarse sand (1.0–0.5 mm); M, medium sand (0.5–0.25 mm); F, fine sand (0.25–0.15 mm); VF, very fine sand (0.15–0.053 mm); Silt (0.053–0.002 mm); Clay (<0.002 mm).



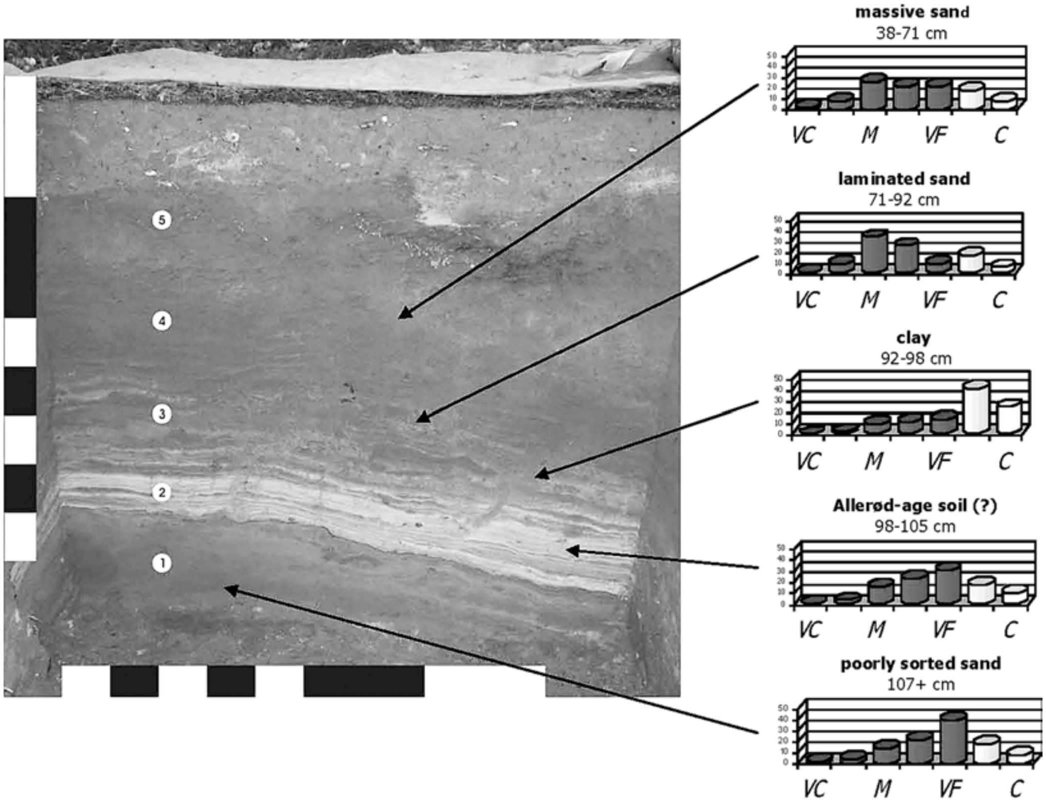
6.13. Typical soil expression at Debert, showing L-F-H, Ae, Bf, B, and C horizons. All horizons show variability in thickness across the site area, which along with other factors reflects the duration of formation. The illuviation of Fe in the Bf horizon typically makes this horizon distinct from those above and below. The gradation from BC to C is often less dramatic.

Further, the presence, relative position, and nature of the A, B, and C soil horizons indicate a great deal about possible disturbances, environmental stability, and the time of formation. A typical podzolic expression for Debert includes an organic L-F-H (litter, fermentation, and humus) horizon underlain by a mineral Ae horizon (eluviations of Fe, Al, and soluble organic compounds—humic and fulvic acids), a Bf horizon (illuviation of Fe, Al, and soluble organic compounds), and the underlying C horizon (parent material) (figure 6.13). Each test unit cannot be fully documented or understood without identifying whether the area is undisturbed (i.e., the Ae is intact and any variation from the typical expression is explained) and how the sediment type (e.g., till, weathered bedrock, cover sands) relates to the soil formation profile.

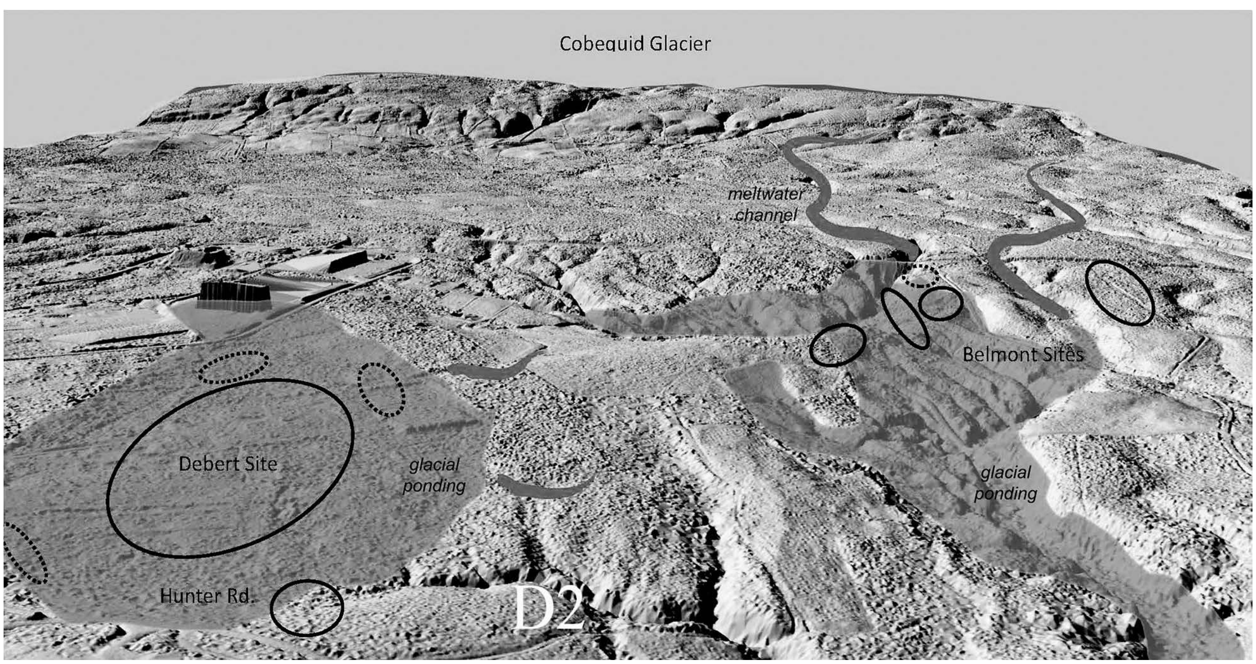
The presence of a soil expression at depth (buried soil or paleosol) at Debert would most likely indicate a previous Allerød soil. These Allerød soils often come with buried peat layers that can be dated and have been the key for tying together a regional stratigraphic chronology by geologists and others working on the paleoclimatic record. Backhoe unit 12–20 exposed what may be a buried soil in the Debert area, although, unfortunately, there are no datable buried organics associated with the unit (figure 6.14). Unit 12–20 is key to the overall interpretation of a Younger Dryas origin for the cover sands. At the site a whitish, weathered, laminated sand was found under reddish brown massive sand and silty clay. This bleached zone overlies a thin iron-cemented layer (placic horizon) and another reddish brown sand unit. In situ organic material, however, was not found in the horizon. The top surface of the unit exhibits involutions indicative of periglacial processes. The similarity of stratigraphy with other buried Allerød paleosols and the presence of involutions suggest that the weathered unit represents a period of ice-free conditions rather than a diagenetic feature such as a redox boundary related to water table fluctuations. The bleached horizon and overlying silty clay were sampled and tested for pollen content but produced no result (R. J. Mott, personal communication, 2006). The correlation of the bleached sand at unit 12–20 with the dated peat beds in regional stratigraphies is important because the cover sands that overlie the presumed paleosol are associated with artifacts in nearby areas.

From the investigations of soils and sediments we are able to reconstruct a working map of the glaciofluvial and glaciolacustrine deposits in relation to the archaeological sites. Figure 6.15 shows Stea's reconstruction of this glacial meltwater with the location of the sites and find locales. This reconstruction continues to be refined, with future versions forthcoming.

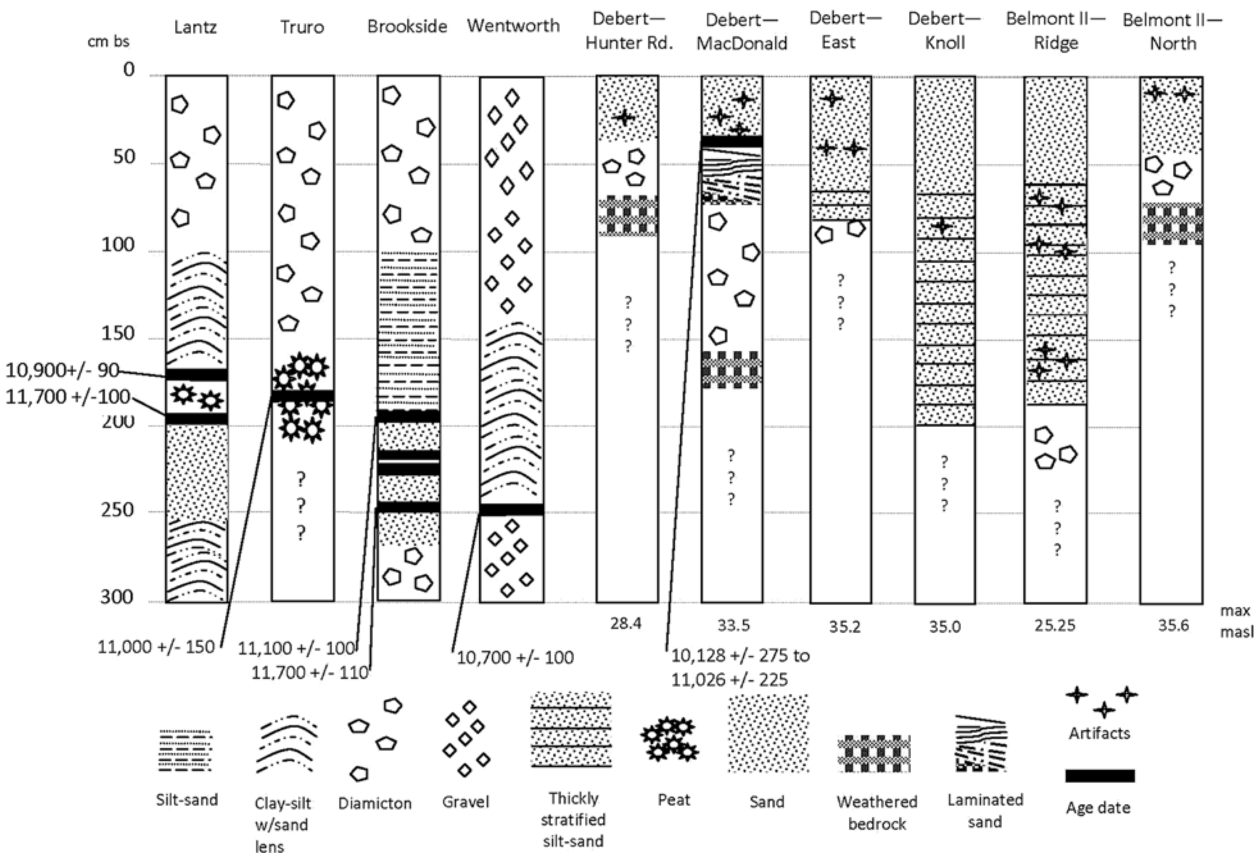
A comparison of the nature and extent of the cover sands within the site complex with similar profiles from nearby geological sections strengthens the case for the sands being of Younger Dryas origin. Since Borns published his work at the time of the Debert excavations, the late glacial/early Holocene climatic record has become increasingly well defined for Nova Scotia. Data from pollen, Coleoptera, and buried peat deposits provide a varied and consistent record



6.14. Unit 12–20 showing a possible buried soil expression. If Zone 2 is an Allerød paleosol, as we believe it is, it indicates that the cover sands above (Zones 3–5) are most likely Younger Dryas in origin. In addition to helping us understand the origin of the cover sands, this section is key to relating the site's stratigraphy with regional stratigraphies (see figure 6.16).



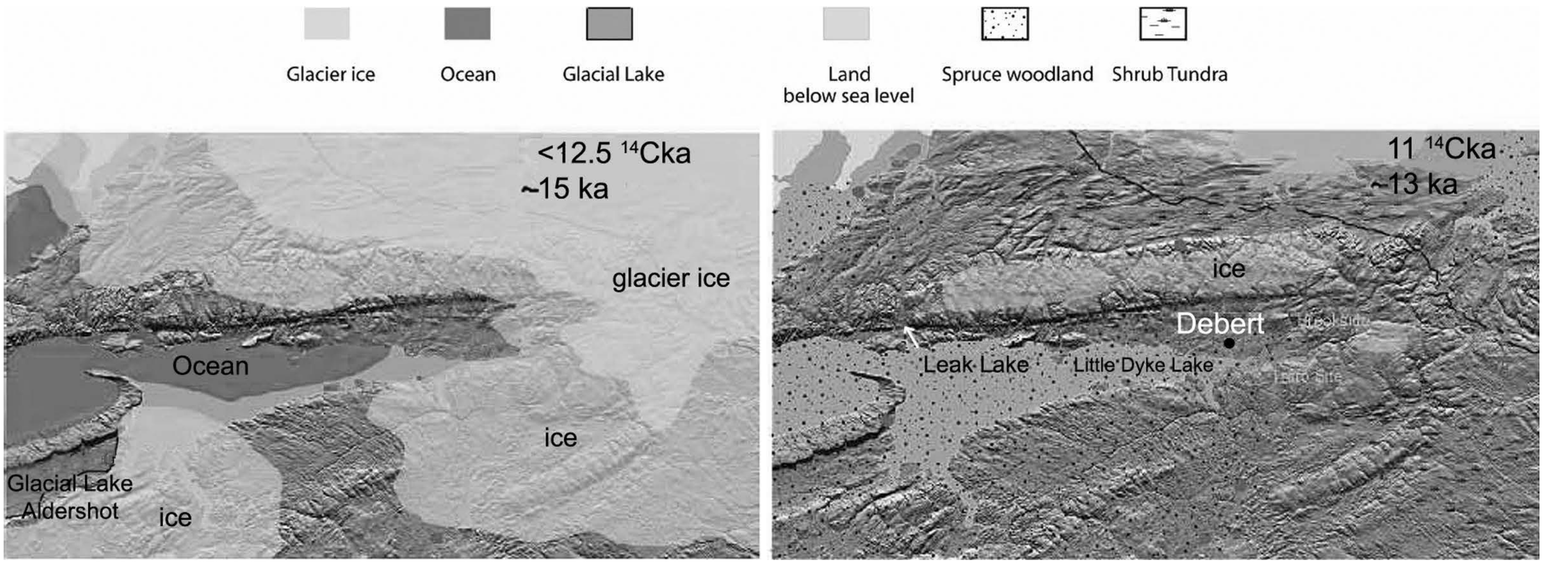
6.15. Oblique LIDAR image showing archaeological sites in relation to the Younger Dryas cover sands, which are the result of ponding and meltwater channels with a Cobequid Mountain origin (top). Dotted lines indicate clusters of positive test units and circles indicate archaeological sites (see figure 6.10). Two additional find locales not mapped here have recently been identified about one kilometer south, adding to the overall complexity of the site area (LIDAR base image courtesy of Tim Webster, College of Geographic Sciences, Lawrencetown, Nova Scotia).



6.16. Comparative stratigraphies of the Debert sites and four nearby geological sections. Note the degree of sedimentation during the Younger Dryas in comparative sections. The Truro and Brookside sites are 20 km distant and the Lantz and Wentworth sites 100 km. The more than two meters of sand and stratified sand at the knoll site is along a side flank of the central ridge; moving a mere 50 cm higher (toward the central knoll), the sand deposit is virtually absent, with a thin veneer of till covering weathered bedrock. In addition, it is important to remember that up to a meter of sediment was removed from the MacDonald site (Brookside: Mott et al. 1986; Lantz and Wentworth: Stea and Mott 1998:12).

of postglacial Allerød warming, the Younger Dryas reversal, and the onset of early Holocene warming (Alley 2000; Frappier 1996; Levesque et al. 1993; Mayle and Cwynar 1995; Mayle et al. 1993; Miller and Elias 2000; Mott 1994; Mott, Grant, Stea, and Occhietti 1986; Stea and Mott 1998). This regional context is critical to an understanding of the origins of the cover sands. Borns (1966:53) argued: "This climate prevailed about 10,600 years ago but lasted only a short time. In fact, permafrost may not have been ubiquitous but sporadic—controlled by local conditions, as in parts of the subarctic today." Recent regional data indicate that the Younger Dryas was a more intense, but short-lived, cooling event between 10,800 and 10,300 ^{14}C yr BP.

Thus the depth and extent of the Debert cover sands are not dissimilar to nearby deposits—in fact, quite the opposite. The section profiles shown in figure 6.16 demonstrate the extent of Younger Dryas sedimentation that has occurred. More extensive data (Stea and Mott 1998) from more than forty lake cores and geological sections demonstrate significant Younger Dryas deposits across Nova Scotia and southeastern New Brunswick. The Debert profiles appear almost shallow in comparison to these sections. It is worth remembering that portions of the surface of the original MacDonald site were reduced considerably by military activity during the 1940s, with MacDonald (1968:18) estimating 6–12 inches and recent LIDAR analyses indicating more than a meter (Stea 2009b:18). Note also the depth of the late glacial Allerød peats buried by clay and till in nearby Lantz, Truro Brookside, and Wentworth, Nova Scotia. Regional work is leading to increasingly refined understandings of the extent of ice and vegetation assemblages through the chronozones. Figure 6.17 (Stea 2009b:Figure 7)



6.17. Extents of glaciation, sea levels, vegetation, and glaciofluvial/glaciolacustrine activity at four times during the late Allerød and Younger Dryas chronozones. Note that the Debert site remains ice free even at the height of the Younger Dryas glaciation at 10,600 ^{14}C yr BP.

shows the most current representation of the extent of ice and corresponding vegetation in relation to the site. Note that the Debert site is ice free at the height of the Younger Dryas.

TWO EXPLANATIONS FOR ONE RECORD

We now turn to the question of the relationships between the cover sands and the cultural and organic materials associated with them in all site locales including the new sites described above. The scenarios detailed below are predicated on assumptions and issues that we either disagree on or agree are unresolved. Let us begin, however, with clear points of agreement:

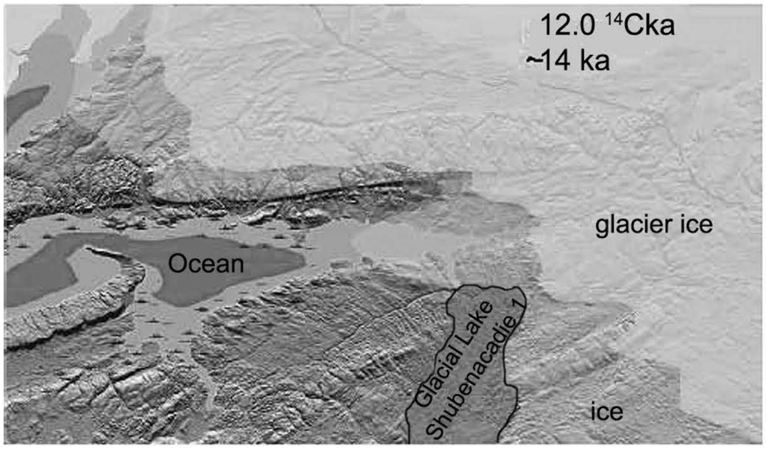
- The site locales and stratigraphic contexts are as reported above.
- The cover sands unit includes unstructured or cryptically laminated facies, bedded facies, and bioturbated facies.
- The depositional environment of the cover sands is glaciofluvial/glaciolacustrine activity associated with the Younger Dryas climatic reversal.
- The radiocarbon dates are anomalous within the region, spanning the "modern radiocarbon gap" that coincides with the Younger Dryas. Further, MacDonald (1968:53) reports that the dates were on *Picea* (spruce), and there is little to no evidence for the presence of *Picea* in the region during the Younger Dryas.

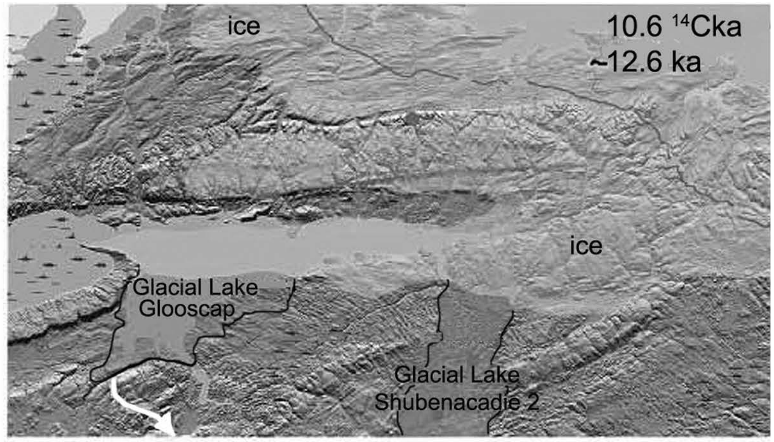
We acknowledge that both scenarios will be well served by future investigations and ongoing research at the sites, and also that both are working explanations that are meant to help us navigate through an increasingly complex record of sites and sediments.

SCENARIO 1: *The cultural materials are late Allerød occupations that were comixed and redeposited with Younger Dryas sands and sediments throughout the site area.*

This scenario holds that it is most likely that the occupations throughout the site complex date to the late Allerød. The anomalies of the Debert dates with regional environmental data as well as the extreme environmental conditions of the Younger Dryas are given priority here, where the cultural materials are interpreted as redeposited after occupation during the glaciofluvial and glaciolacustrine activity of the Younger Dryas.

Spruce charcoal fragments from hearth features at the

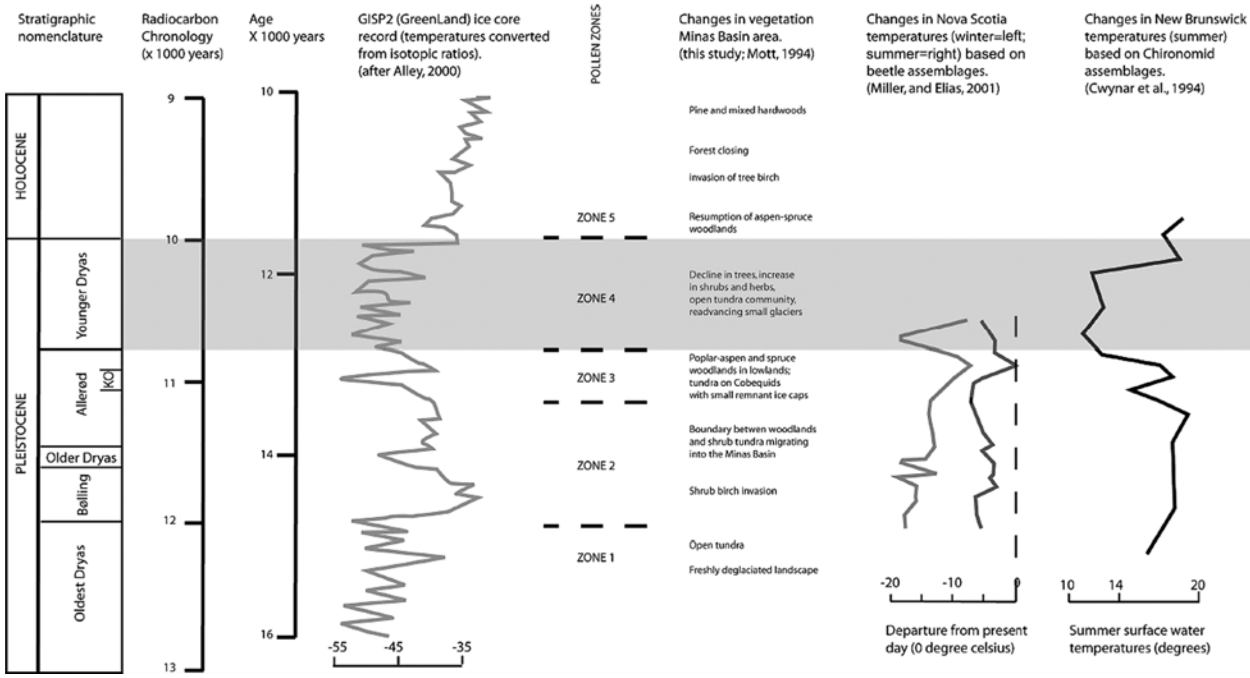




original Debert site were radiocarbon-dated in the early 1960s and range in age from 11,026 to 10,128 ^{14}C yr BP with an average of 10,600 ^{14}C yr BP (see table 6.1 for a complete list of dates and calibrations). Some of these hearth features, however, were anomalously young, dated at 7685 ± 92 and 5033 ± 70 ^{14}C yr BP (MacDonald 1968:52–56). Davis (1991:51–53) suggested that occupation of the original Debert site occurred at about the time of the oldest two dates in the original series (11,000–10,800 ^{14}C yr BP) and that the youngest dates reflect humic acid or rootlet ("young" carbon) contamination. He cited a dating test done at the Vail site by Gramly (1982) in which duplicate wood samples were sent to different labs and produced radiocarbon dates of 11,100 and 10,300 ^{14}C yr BP. The actual occupation time span of the original Debert site as interpreted from the artifact types and distribution was likely only a few decades (MacDonald 1968:133).

Paleobotanical compilation (figure 6.17) can be used to interpret the time of first occupation. MacDonald (1968) determined that hearths associated with Clovis artifacts at the site contained spruce charcoal and suggested that firewood and kindling were readily available. This interpretation is not compatible with the sparsely treed or treeless tundra environment postulated for the Younger Dryas at about 10,600 ^{14}C yr BP but more in keeping with the preceding late Allerød period when a spruce forest was established in the area (Frappier 1996). A readvancing glacier in these lowland areas as documented by Stea and Mott (2005) implies a snowline during the Younger Dryas close to sea level—in other words, periods during the Younger Dryas when winter snowfall did not melt during the summer months. This scenario would be disastrous for plant and animal life and unlikely to sustain a hunting camp for significant periods of time. Indeed, MacDonald (1968:133) suggested a short-lived occupation. By contrast, during the late Allerød the climate had warmed to the point where summer temperatures were compatible with today (figure 6.18), and remnant ice caps in the Cobequid Highlands assured an abundant water supply for migrating caribou herds. The abundance of charcoal and spruce in the hearth features at the original Debert site and the presence of charcoal and abundant spruce pollen at the zone 3/4 boundary layer at Little Dyke Lake suggest that these deposits are contemporaneous with occupation of the original Debert site and best placed at the Allerød/Younger Dryas boundary at 11,000–10,800 ^{14}C yr BP (13,000–12,800 cal BP).

The sediments described as structureless sands that overlie the hearth features and contain artifacts were interpreted by MacDonald (1968) as bioturbated deposits and the underlying laminated sands as eolian deposits. Sedimentological interpretation of the original Debert site was hampered by the removal of the meter of overlying sediment. Davis (personal communication, 1990) excavated the nearby Belmont II site and found artifacts buried in the cover sands unit well below the Holocene soil profile. New data reported here reveal artifacts more than a meter below the present solum at the Belmont II ridge site (see figure 6.16). Brewster (2006) noted that soil-mixing processes (i.e., bioturbation, cryoturbation) alone may not explain fully the vertical distribution and depth of artifacts at the Belmont site. Stratigraphic sections around the original Debert site also reveal structureless/cover sands overlying laminated



6.18. Chronology, climate, and pollen stratigraphy compared with the temperature record of a Greenland ice core.

sand, but these appear to be primary sedimentary deposits rather than postdepositionally mixed deposits, and at one locality (unit 12–20; figure 6.14) they overlie a possible buried soil (Stea 2006). Unfortunately this section did not contain artifacts. Stea (2006) interpreted laminated sands at unit 12–20 that contain clay layers as lacustrine deposits, and overlying cover sands deposits as a debris flow or series of debris flows rapidly deposited into a pond or lake.

If the cover sands deposits at the original Debert site and adjacent sections are all correlative, and primary in nature, then the structureless sands containing artifacts may be equivalent to the Younger Dryas sand and clay deposits mapped regionally. Stea (2006) suggested that some of the artifacts and charcoal from the hearth features were reworked from an Allerød paleosol horizon by debris flows at the end of the Younger Dryas.

SCENARIO 2: *The site complex area was occupied in numerous locales and times within the Younger Dryas, with depositional events before and after occupations.*

In the second scenario we maintain that the archaeological data are a largely in situ record and allow that people can live in extreme environmental conditions, which suggests an explanation as to how the cultural materials are present within the Younger Dryas deposits. We are agreed that there is clear conflict between the radiocarbon dates at the original Debert site and the surrounding paleoclimatic data; this is difficult to dispute under any circumstances. Despite our agreement on this chronometric issue, we cannot all accept that the cultural materials are redeposited from previous late Allerød occupations, as argued in the first scenario. We cannot disregard the site integrity that MacDonald documented more than forty years ago. Further, although we can conceive that it is possible that the dates indicate forest fires and that the features were mere tree throws, as argued by Bonnichsen and Will (1999:405–407), MacDonald's (1968:20) data and discussion make it clear that he knew the distinction between hearths and tree throws and had identified instances of tree throws that were disregarded in his analysis.

More to the point, MacDonald's analyses of the cultural features simply make it very difficult to read these patterns as those created from redeposited contexts. He concedes that the vertical stratigraphy was destroyed by natural factors: "Although the movement of artifacts by natural factors has been sufficient to destroy vertical stratigraphic relationships at the site, artifact displacement of the same hori-

zontal order does not significantly alter the distributional pattern within the sections" (1968:21). His evidence for the horizontal integrity of the site is discussed in several places, including the section descriptions and his summary discussion of settlement patterns. He is clear that there was a nucleated pattern to the findings and a logic and consistency to the spatial patterns of artifacts within the sections (1968:21). Except for Section F, MacDonald thought that all of the central sections at the site were single occupations or living floors (1968:21–23).

His discussion of the living floors is perhaps the strongest argument for the integrity of the data: "On these floors, which average about 1,200 square feet, a pattern of multiple hearths aligned in an axis from north to south is evident. . . . The best-preserved floor was that in section J, where it was noted that artifacts clustered around the hearths and in a rim on the periphery of the floor. A second concentration, in the featureless area to the south of the hearths, was also noted" (MacDonald 1968:132–133). This featureless area is interpreted as an open area in front of the dwelling, with MacDonald drawing from known ethnographic practice of the Innu of using such a sunny exposure in inclement environmental conditions.

Section D gives us an excellent example of an archaeological pattern that demonstrates a best case for integrity to the archaeological data, in part because of the artifacts but also because of the hearths. MacDonald (1968:38) writes that the artifact concentrations were roughly circular, with seven distinct hearths concentrated in the center of the section, forming Feature 7. Associated with these hearths was "the exceedingly high concentration of waste flakes, as high as 1,300 per five-foot square, found between the hearth pits. Indeed the waste flake to artifact ratio for the entire section was a record high of 30:1 with unfinished points, and point performs, as well as other bifacial tools, many times their normal frequency" (1968:38).

Subsequent visual examination showed signs of heat treatment. In addition to these patterns and associations, Section D was the source of many crossmends with artifacts in other sections. MacDonald concludes that the section is tempering hearth and, "as such, it is an important record of a technological practice." We cannot see that this kind of archaeological record can be redeposited—and in fact these data are among the tightest and best from this period in the region. The more we read and reread MacDonald, the more it is clear that he anticipated a great number of the questions that we are still addressing many decades later.

We cannot resolve the discrepancy between the site's dates and those from regional paleoclimatic data, and this conflict continues to demand explanation. The description of Feature 7 in Section D (along with other provenience information from the site) complicates this debate further. Tree throw patterns do not cluster in nice hearthlike features, replete with logical artifact concentrations. We would note that the only distinction between the Debert site and the regional paleoclimatic dates is that there are human beings at the Debert site. This suggests to us that human activity of one kind or another holds the answer to the discrepancy. Spruce can be sparsely populated along riparian zones above the treeline (Esdale et al. 2001), allowing for its presence in arctic climates even if not sufficiently present in the (relative) pollen record. The fact that (probably) spruce was the only source for the charcoal, according to MacDonald (1968:53), supports the argument for selection of the species by some factor. Why not a human one? The fact that the calibrated dates for the Younger Dryas result in a plateau does not assist us in this case either. The regional paleoclimatic data clearly demonstrate the onset of the Younger Dryas at 10,800 ^{14}C yr BP; a few of the early Debert dates span this transition, but that does not explain why the majority of the Younger Dryas dates from Debert are not replicated in the paleoclimatic data. In any case, we do not have a fully satisfactory answer for this conflict.

Regardless of the discrepancy with the dates, if the cultural materials have spatial (horizontal) integrity—which we believe they do—and the sands are Younger Dryas—which we agree they are—it seems to us that the occupations must be Younger Dryas occupations. This means that if (somehow) the dates can be proven to be older than they are, then either the cover sands are not a Younger Dryas deposit or the archaeological record is not in situ. Is it not possible that people arrived in the area after initial deposition, occupied and reoccupied the area (as the now large number of sites and stratigraphic contexts indicate), and then there was additional subsequent deposition? The association with and distribution of all of the sites and find locales except Belmont I over the central ridge in the site area suggest to us that, if anything, the occupations are middle

to late Younger Dryas, given that the meltwater channels on either side of the original Debert site and those north of the Belmont sites appear to have been cut by the time of occupation (since the sites do not overlap these channels). MacDonald said this same thing forty years ago about the channel that separates the main site from Section 1: "A shallow trough, now filled with aeolian sediments, cuts through the northern flank of the site and probably carried meltwater in late-glacial times. All evidence points to the fact that it had ceased to be active by the time of occupation. The site is located on a low sandy ridge which drops in elevation from west to east about one foot in every hundred on the long axis. . . . Because of the relief and the porous nature of the sandy soil, drainage in the area of occupation is good" (1968:3, 6).

We think those sediments are glaciofluvial rather than eolian, but the temporal relationship of the occupation to the formation of the channel still holds in our opinion. Stea and Mott (1998, 2005) interpret southern Nova Scotia as being ice free during the Younger Dryas (Stea and Mott 1998, patterns of mineral oscillation). This presents the intriguing possibility of a northern foray into the Debert area for caribou or other game interception and retreat to better conditions farther south. We have barely engaged the question of whether people could have lived in the extreme conditions of the Younger Dryas, for the ethnographic and archaeological literature of people living in extreme environmental conditions is extensive (e.g., Pitulko et al. 2004; see Yesner 1994). Most often eastern Paleoindians are analogized to northern subarctic peoples (and often specifically to the Innu of Labrador, as with MacDonald), for whom environmental conditions were harsh and resources thin (Newby et al. 2005:150). Recent work in the Yukon Ice Patch project (Farnell et al. 2004; Hare et al. 2004) demonstrates one example of intimate relationships among people, ice sheets, and caribou. Further, it is clear that there were people living in extreme conditions at other sites in the Far Northeast during this early Paleoindian period.

It is critical for us also to be clear that what we have presented here is the very first cut of the data from the new finds. There is a great deal of subsequent analysis of the data and more surveys currently planned. Perhaps the most intriguing of possibilities are that there is a chronological sequence between what appears to be the Debert site and Hunter Road site clusters and the Belmont clusters and a correlation between the stratigraphic contexts and the topographic elevations of the current site and find locales. Without more stratigraphic analysis and firm chronological control, we are not yet able to develop this discussion further.

CONCLUSIONS

The new finds at the Debert-Belmont sites in relation to the depositional model put forth in this chapter expand our perspectives and provide new challenges with respect to the site complex. The two scenarios for the stratigraphic contexts of artifact finds within the glaciofluvial deposits leave us much to debate and understand. The dramatic environmental change during the Younger Dryas means that small differences in chronology and stratigraphy have significant consequences for understanding life at the sites—either as one with relatively easy access to resources or as one in much more extreme conditions. The extent of the occupations and the varied stratigraphic contexts associated with the central ridge and the side terrace deposits at Belmont II strongly suggest that the emergent site pattern represents multiple (re)occupations of the area, in agreement with other recent interpretations (Ellis and Deller 2000:242, as cited in Robinson et al. 2009:428). Not including the two new additional sites found within a kilometer of the Debert-Belmont complex, the site complex now has six sites and four additional loci covering more than 100 ha. There are many implications for modeling life at Debert—from the new data from caribou hunters (Robinson et al. 2009; Spiess et al. 1998) and birds (Dincauze and Jacobson 2001) to the last of the megafauna (Hoyle et al. 2004; Miller et al. 2000; Woodman and Athfield 2009) and the duration and potential reoccupation of the sites over more than a millennium.

The testing strategy employed by the Debert Site Delineation Project and required by the new Debert regulations is producing significant results, with the identification of several new sites during impact assessments on the neighboring industrial lands. There is, of course, considerable future research potential to refine the relationship of these new sites with the growing understanding of the glacial history of the area. As assessments proceed under

the new regulations, we anticipate further progress in extending our understanding of depositional patterns and site contexts within the industrial lands surrounding the Debert-Belmont complex. Further refinements to the general interpretive framework are anticipated on completion of the Site Delineation Project, which has already produced a large body of detailed stratigraphic information. The final analysis and stratigraphic modeling of survey data will significantly advance a broader understanding of the relative chronologies, contexts, and relationships among site occupations in the area.

It is worth making note in reference of the recent intense politicization, public attention, and academic debate about First Nation involvement with, and relationship to, the oldest sites in North America (Bradley and Stanford 2004, 2006; Bruning 2006; Burke et al. 2008; Chatters 2000; Colwell-Chanthaphonh et al. 2010; Edgar et al. 2007; Egan 1998; Fiedel 2004; Kluger and Cray 2006; Lemonick and Cray 1996; Lemonick et al. 2006; McGhee 2008; Murr 1999, 2005; Owsley and Jantz 2001; Preston 1997, 1998; Sanders 2004; Straus 2000; Straus et al. 2005; Swedlund and Anderson 1999, 2003; Thomas 2000; Wilford 1999). The Confederacy of Mainland Mi'kmaq took the lead to work closely with the Province of Nova Scotia on the protection of these important places in a quiet but determined and consistent manner well before the development of these contentious battles in the discipline, media, and courts. The ongoing research reported here is one of several direct and anticipated outcomes of an in-depth and comprehensive site management strategy guided by the Mi'kmawey Debert Elders' Advisory Council through the Confederacy and on behalf of the Assembly of Nova Scotia Mi'kmaw Chiefs. Although the Mi'kmawey Debert Elders' Advisory Council departs from much disciplinary thought in critical ways including ideas of descent, healing, and spirituality (Julien et al. 2008), this group of elders and the leadership of the Mi'kmaw Nation have placed a priority on the protection of these very special places with vital outcomes for future generations.

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Perhaps most important, we would not have the present volume of site and stratigraphic data without the dedicated perseverance of the Confederacy's field crews in carefully documenting more than 7 km of stratigraphic profiles under physically challenging and frequently demanding field conditions over the past four seasons: Danny Dyke, Sharon Farrell, Donna Morris, Stephen 'Flash' Julian, Justin Lewis, Katie LeBlanc, Gerald D. Gloade, Kelly Peters, Michelle Lelièvre, Kyle Tuplin, Hannah MacNevin, Emily Wiggin, Michael Stephens, Claire Sylliboy, Rhonda Knockwood, Matthew Martin, Philip Martin, James Stevens, Rebecca Thomas, Zachary Knox, Natalie Gracie, Kenzie Jessome, Ashley deYoung, Erin Whiteley, Robin Crook, Ben Pentz, Matt Munro, Bev Perley, Emma Sampson, Dylan Gloade, Allie Mason, and Nigel Henderson.

NOTES

1. The Confederacy is one of two Mi'kmaw First Nation tribal councils in Nova Scotia. See www.cmmns.com.

2. See www.gov.ns.ca/just/regulations/regs/sppdebert.htm and www.gov.ns.ca/Tch/pubs/Debert_Testing_Standards.pdf.

3. This area includes only the excavation units at the Debert site. We have not included the area between Section 1 and the other units because Section 1 sits more than 200 m north of the primary site area.

4. See http://gov.ns.ca/abor/officeofaboriginalaffairs/whatwedo/negotiations and www.mikmaqrights.com.

5. The strategy was developed by a joint committee of archaeologists from the Confederacy, Kwilmu'kw Maw-klusaqn, the Nova Scotia Heritage Division, and Parks Canada. It is worth noting that the most important distinction between the Debert regulations and existing practice in the province is that the new regulations *require* testing prior to development whereas the existing regulations of the Nova Scotia Special Places Protection Act can strongly recommend, but not require, such testing by development proponents.

6. The Stea and Brewster reports are currently only on file at the Confederacy, but the 2005 and 2006 reports form the basis for their contributions to the proceedings from the 2005 Debert research workshop (Bernard et al. 2011).

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CHAPTER VII

The Early Paleoindian Occupation at the Cliche-Rancourt Site, Southeastern Quebec

Claude Chapdelaine

Before the surprising discovery of the first two fragmented fluted points at the Cliche-Rancourt site (BiEr-14) in August 2003, all of the province of Quebec was excluded from the "Clovis Club"—the territories that attested to the presence of the first settlers of the Far Northeast during the late Pleistocene. Sites such as Reagen in Vermont (Ritchie 1953; see also F. Robinson, this volume) and Vail in Maine (Gramly 1982, 1985) are located near the Quebec border, and most scholars thought that it was only a matter of time before the first fluted point would be discovered in Quebec. Curiously, it was not found in an old antiquarian closet, in the middle of a ploughed field, or under a tree throw but in a controlled excavation (Chapdelaine 2004).

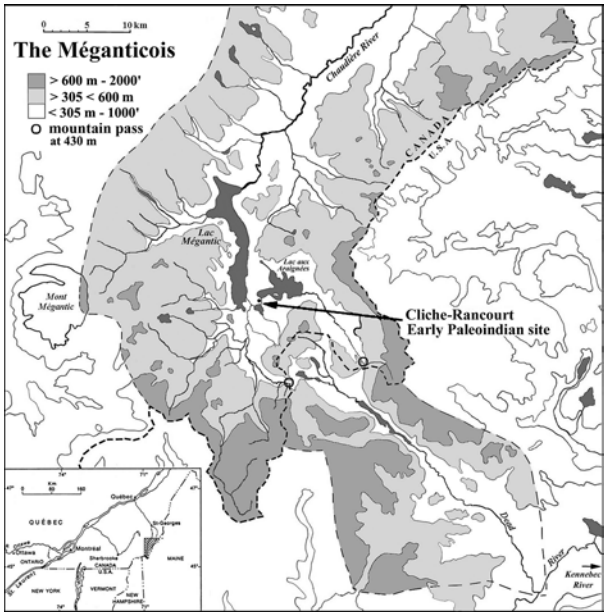
The site sits on a flat terrace above a small river and the forest cover is relatively intact, giving the impression that natural disturbance was kept to a minimum although a highway was built early in the twentieth century about 20 m west of the site.

A synthesis of what was known of the site has been published in French (Chapdelaine 2007). Results of fieldwork carried out between 2002 and 2006 were summarized, and they are included here in the tool and debitage description along with new results generated between 2006 and 2009, in order to provide a general overview of the Cliche-Rancourt site. The excavation program reached the end of a second phase in 2009, and future work at the site will be carried out at a slower pace, concentrating on the development of a heritage center.

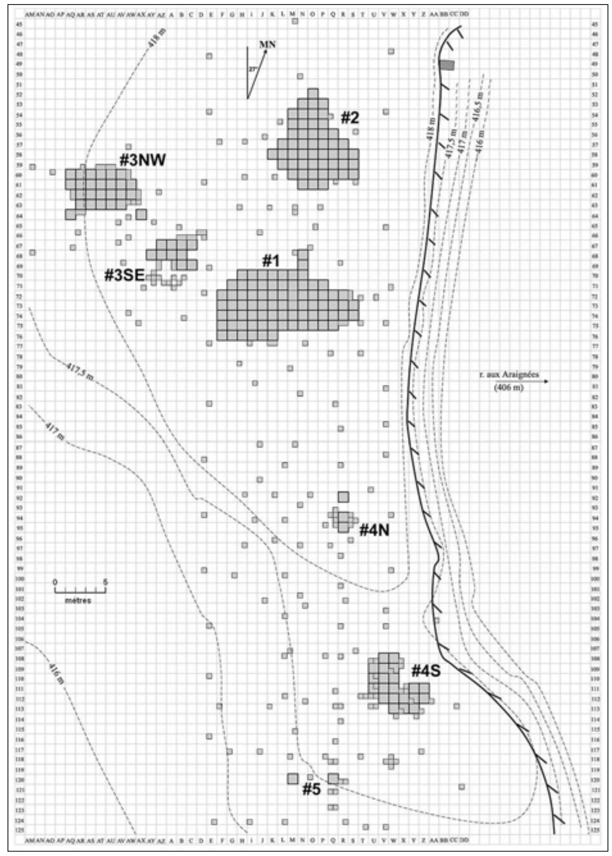
This chapter deals exclusively with the Early Paleoindian occupation, leaving aside data identified to a Late Paleoindian occupation. Information can be found elsewhere on this bifacial industry of lanceolate projectile points made on Mount Kineo rhyolite (Chapdelaine 2004, 2007, 2009) and is referred to in this volume in chapter 8 by Courchesne and collaborators. This Late Paleoindian occupation is horizontally and vertically well segregated from the older occupation, which explains the necessity of using this set of data to show that the depth of the Early Paleoindian artifacts in the deposit is strikingly different.

HISTORY OF RESEARCH

The Cliche-Rancourt site was discovered in 1995 during a survey specifically looking for Paleoindian sites (Ethnoscop 1995) (figure 7.1). Only a few artifacts were uncovered through systematic testing of the sandy terrace, and the site was considered a small and brief portage of unknown



7.1. General location of the Cliche-Rancourt site within the Méganticois.



7.2. Map of the Cliche-Rancourt site.

cultural affiliation. The field school of the Université de Montréal Department of Anthropology started a long-term project in the Mégantic Lake area in 2001, focusing on known sites capable of establishing a cultural and chronological framework (Chapdelaine 2009). In 2002 the Cliche-Rancourt site was tested to verify the possibility of pursuing field school investigations. Two transects were set up parallel to the edge of the terrace bordering the Araignées River, and test pits were excavated at 5 m intervals. We were lucky enough to find high densities of flakes in two of those test pits along with a few flakes identified visually as red Munsungun chert as well as the distal end of a large biface made of New Hampshire spherulitic rhyolite. These positive results were sufficient to include the Cliche-Rancourt site in our research program for 2003. One week (seven days of fieldwork) was dedicated to this site, and several tools attributable to the Early Paleoindian period were uncovered, including the distal end of a fluted point with a channel flake that could be mended onto it and an unfinished fluted point base with flutes on both sides, one showing the typical outrepassé failure that removed the tip of the point.

Starting in 2004, the Cliche-Rancourt site became the center of our archaeological program. Year after year, we were able to spend three weeks working on different sectors of this site. The year 2009 could be considered the last for the investigation in the northern part of the site. Future research will be concentrated in the southwestern portion of the site. The site covers a rectangle of about 2,450 m^2 (70 m by 35 m), and 245 m^2 (10 percent) has been excavated so far (figure 7.2). The site is divided into five areas, each delimited by a sharp decline in artifact density or a complete lack of artifacts between each locus. The excavation could be considered completed for Areas 1, 2, and 3 regarding the Paleoindian occupation. Area 4 is now considered an Archaic component, and preliminary data from the 2009 field season are used to assign the new Area 5 located at the southwestern portion of the site, 15 m^2 in size, to the Early Paleoindian period.

PHYSICAL SETTING

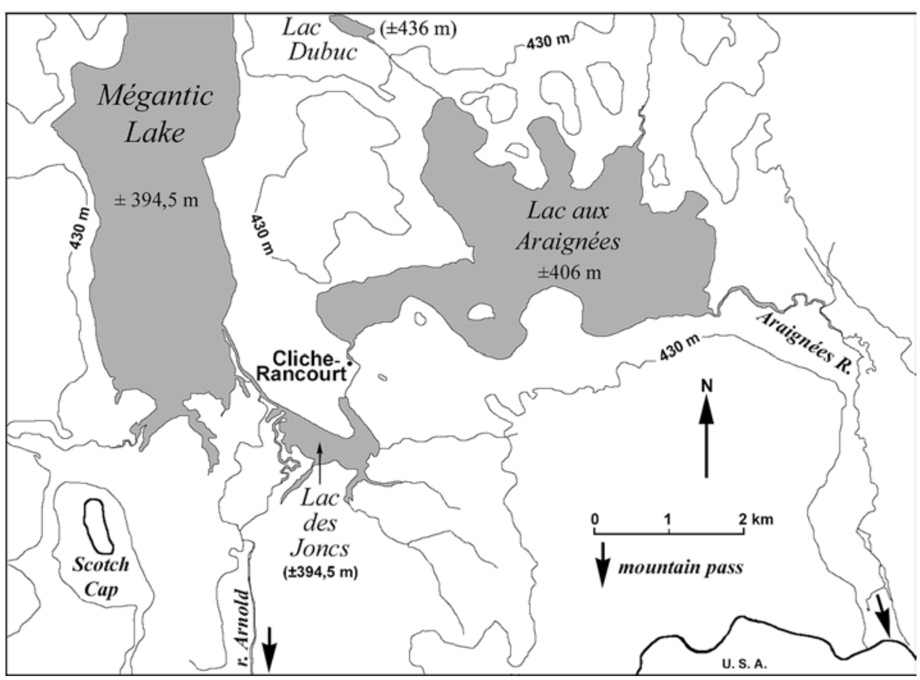
The Cliche-Rancourt site occupies a sandy terrace of fluvioglacial origin. The site is bordered to the east by the Araignées River that flows from Araignées Lake toward the south and southwest to reach Mégantic Lake (figure 7.3).

The terrace sits at 418 m above sea level, which is 12 m above the Araignées River. The latter is at an altitude of 408 m, but its level is artificially higher by two meters because of a dam at the foot of the kilometer-long rapids, which start right in front of the site. The sandy terrace is flat, well drained, and was never flooded after the drainage of proglacial Lake Chaudière, which occurred after the invasion of the Champlain Sea around 13,100 years ago in the Quebec City area with the freeing up of the lower Chaudière River (Richard 2007; Richard and Occhietti 2005). The maximum height of proglacial Lake Chaudière was 430 m, and after flooding the Cliche-Rancourt site for several centuries the water level dropped constantly after 13,300 years ago.

The emergence of the 418 m terrace is not dated, but it is plausible that the drainage was completed within an interval of 200 years or less after the Chaudière River estuary was free of ice. This scenario offers a landscape favorable for settlement well before the arrival of the Early Paleoindians in the area. This reconstruction of land emergence points to the possibility that the actual water level was similar 12,500 years ago. The well-drained sandy terrace as well as the ecological position of the Cliche-Rancourt site may have attracted the first settlers. During the presumed occupation of the site between 12,500 and 12,200 years ago, the Younger Dryas was prevailing (Newby et al. 2005), and the cold climate had a strong impact on natural resources. A tundra landscape may have prevailed (see Richard 2007).

The nomads who moved north to reach the Mégantic Lake area were probably traveling by foot, and they knew how to cross rivers. The geographic position of the Cliche-Rancourt site is unusual in not being a dead end. Crossing the 430 m high mountain pass at Coburn Gore, up the Dead River that empties south into the Kennebec River, hunters could stop at Cliche-Rancourt, move up the Araignées River at the northern end of Araignées Lake, and end up crossing a second mountain pass at 430 m above sea level that also leads to the Dead River drainage (see figure 7.1). The two mountain passes at the same altitude constitute a true advantage for anyone who needs to go from the Kennebec/Dead River basin to the Chaudière River basin. From the Quebec side, a climb of less than 15 m is required to clear the height of land if the isostatic rebound ended rapidly in the region. The geographic connection between Cliche-Rancourt and sites located within or near the Kennebec River drainage is thus easy to understand.

Cliche-Rancourt is among the northernmost known sites of the Early Paleoindian period in the Far Northeast, at a latitude of 45°27'37" North (longitude 70° 51' 05" East). Its ecological position is strategic, allowing an easy return to the south using the two equally passable mountain passes.



7.3. Map of the Mégantic Lake area.

Its northern landscape was favorable to barren-ground caribou at a time when forest growth was blooming to the south. Crossing the Boundary Mountains led to a new landscape, colder but rich at the end of the summer if caribou herds were moving toward the mountain passes. Paleoindian hunters occupied this northern landscape to intercept this gregarious prey species, although no bones have been found to support this interpretation at the Cliche-Rancourt site. Soil acidity prevented the preservation of animal bones, and paleoenvironmental reconstruction is thus necessary to propose a plausible human adaptation.

The actual forest cover is dominated by coniferous trees and, as a result of cold winters, the soil is classified as a gleyed humoferric podzol. This type of soil is very acidic and does not allow good preservation of organic materials such as bone, ivory, or antler. The site stratigraphy is a good example of a mesic station with its good drainage, at least in the upper 75 cm of the profile. The topsoil is very thin, the organic horizons are thinner than 10 cm, and they are followed by Ae and spodic B horizons. This gray Ae horizon varies in thickness, since it is often related to tree throws, with irregular depressions that reach 30–35 cm in depth. Under the Ae, the mineral layer or B horizon consists of an orange, sandy, and iron oxide–rich material. This layer could reach up to 40 cm thickness, with the usual loss of coloration with the reduction of iron oxides in its lower portion. The IICg horizon has an estimated thickness of 1–2 m (Shilts 1981). The transition between the podzolic B and IICg horizons is characterized by a marked increase in sediment compaction and in specific density. Artifacts have been found in this transitional layer, as well as above in the Ae and B horizons (see Courchesne et al., this volume).

The method of excavation was constant over the years; the sediments were dug in arbitrary levels with a trowel and screened through 3 mm mesh. The first arbitrary layer was 0–10 cm to take out the humus and expose the Ae horizon. All of the other arbitrary levels were 5 cm thick. Excavations were carried out to 40 cm below the actual surface and could be stopped after excavating two consecutive sterile layers, making the average depth 50 cm. In several instances we had to dig to lower depths, encountering artifacts at 60 cm, 70 cm, and sometimes 80 cm below the actual surface. The vertical distribution of artifacts is intriguing, since this phenomenon is absent from all other prehistoric sites of the Mégantic Lake area. No cultural factors could explain this vertical distribution, and a pedological analysis of Area 3NW was conducted to investigate natural factors that might explain the presence of artifacts in the mineral horizon at depths well below the expected phytoturbation created by tree throws (see Courchesne et al., this volume). Cryoturbation in relation to the cold climatic episode of the Younger Dryas seems to partially explain the vertical distribution of artifacts.

Table 7.1. Early Paleoindian Lithic Assemblage from the Cliche-Rancourt Site

Tools	*TOTAL*
Points	9
Bifaces	29
Endscrapers	9
Sidescrapers	29
Gravers	27
Wedges	11
Utilized flakes	288
Total of tools	402
Nucleus/cores	6
Flake debitage	11,176
Total	11,584

Covers 2000–2009, including results of the 2009 field season in Areas 3 and 5.

The Cliche-Rancourt site is not considered rich, but it is not poor either. It is probably a mid-size settlement with a minimum of five loci (Areas 1, 2, 3NW, 3SE, and 5) distributed irregularly and varying also in size (see figure 7.2). The following artifact descriptions include all the cultural remains without regard to provenance; in a later section we consider their affiliations to specific areas as a means to understanding the internal spatial distributions and proposing various domestic activities. The assemblage consists of 402 tools, mostly utilized flakes (72 percent), and more than 11,000 pieces of debitage (table 7.1).

TOOL ASSEMBLAGE

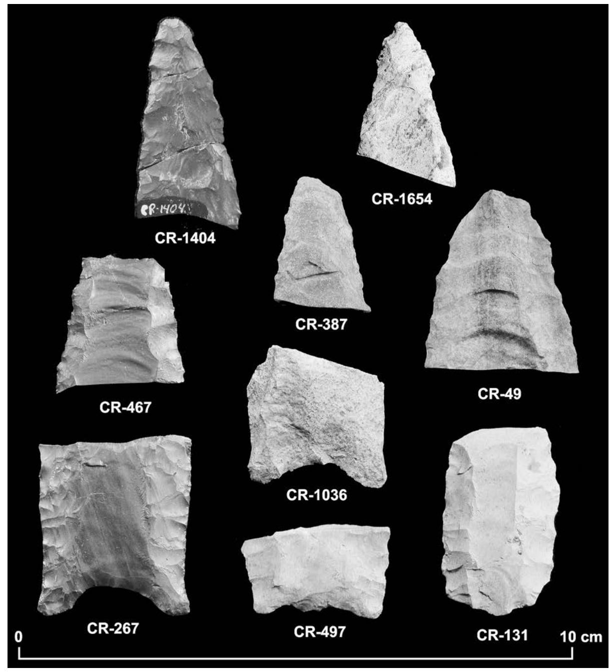
The tool assemblage can be divided into three categories: bifacial tools, unifacial tools, and specimens exhibiting sporadic edge retouch or simply edge damage as a result of

having been used on another material, producing different types of scars. This third category, labeled "utilized flakes," is the most common category, 72 percent of the total tool assemblage. The formal tools, especially the ones carefully reduced on both sides, are few, and a detailed description is warranted.

Bifacial tools are limited at the Cliche-Rancourt site; only points and bifaces are represented. Fluted drills, often made on recycled fluted points, are absent, as are large wedges, or "pièces esquillées," made on fragmented bifaces. The fluted point is certainly the most important tool when developing a typology, building a chronology, and reconstructing the reduction sequence of a sophisticated implement from its production, use, curation, and abandonment.

The Cliche-Rancourt collection contains nine points, all fragmented, eight of which exhibit traces of a channel flake (figure 7.4). The nonfluted specimen was probably broken during manufacture before the first attempt to produce a fluted base. The distal end is classified as a point on the basis of its thickness, width, and well-finished edges. Comparing the length of the distal end to other point fragments, a flute scar would have been visible if basal thinning had been attempted, since our fragment is well over the estimated half length of other points and the tendency of our fluted points is for the channel flake to cover more than 50 percent of the total length (table 7.2). The nonfluted distal end is thus unique in the assemblage, providing support for the idea that hunters arrived at the site with unfinished points awaiting the final step in the production process, which is most often the thinning of the base by the removal of channel flakes on both sides.

The fluted point fragments can be divided into two groups: four bases and four distal ends showing traces of fluted scars. The four bases show various stages of finishing: specimen CR-131 was broken at the site when the second channel flake was removed; CR-497 broke during the first fluting attempt; CR-267 and CR-1036 are two finished bases that exhibit some grinding on their edges, suggesting that they had been attached to wooden spear shafts, used, broken during a hunting trip, and discarded on the site with the tips missing. Three bases are channeled over their entire lengths, providing us with a clue about the knappers' desire to cover most of the surfaces of the points with a flute.



7.4. Projectile points, Cliche-Rancourt site: CR-1404 and CR-467, red Munsungun chert; CR-267, possibly a green variety of Munsungun chert; CR-1036, CR-387, and CR-1654, New Hampshire rhyolite; CR-49, CR-497, and CR-131, weathered chert or rhyolite.

The estimated length of these channel flakes is probably over 50 percent of the complete length of the points. The distal ends convincingly support this tendency, with the ends of the fluting scars near the tips. Specimen CR-467 is the only distal end showing fluted scars on both faces, and three bases are fluted on both faces. The distal end that was fluted on both faces exhibits heavy utilization; the other three were not used but broken during manufacture. The removal of channel flakes was costly at least four times, being the cause of point breakage. Specimen CR-387 is too small to be explained. Distal end CR-49, which mends with long channel flake CR-147 (Chapdelaine 2007:73), has an unfinished tip, indicating that removal of channel flakes at the base was not always the last step in the production process (Storck 1997:60). The finishing touches on probably six of the nine points were carried out at the site, supporting the hypothesis that one activity at the Cliche-Rancourt site was to finish points preparatory to hunting.

The eight fluted point fragments support the hypothesis that the fluted scars covered more than 50 percent of the entire length of the points. We examine this tendency

Table 7.2. Major Attributes of Fragmented Fluted Points, Cliche-Rancourt Site

Artifact No.	CR-49 + CR-147	CR-131	CR-267	CR-497	CR-467	CR-387	CR-1036	CR-1404 + 1744 + 1839	CR-1654
Material	gray-black mottled chert	weathered green chert	green-black mottled chert	weathered green chert	Munsungun red chert	New Hampshire rhyolite	New Hampshire rhyolite	Munsungun red chert	New Hampshire rhyolite
Condition	distal end + channel flake	base	base	base	distal end	distal end	base	distal end	distal end
Face angle	-	90°	91.5°	96°	-	-	92°	-	-
Length	75.0 mm*	35.5 mm*	33 mm*	17.1 mm*	26.7 mm*	25.2 mm*	25.1 mm*	42.2 mm*	30.2 mm*
Width	28.0 mm*	21.4 mm	27.9 mm	27.2 mm	23.4 mm*	17.8 mm*	25.4 mm	19.6 mm*	18.0 mm*
Thickness	5.4 mm*	5.1 mm*	5.6 mm*	4.7 mm*	4.7 mm*	4.9 mm*	7.4 mm*	4.5 mm*	3.6 mm*
Base width	-	19.8 mm	27.6 mm	23.6 mm	-	-	25.4 mm	-	-
Base concavity depth	-	unfinished base	6 mm	unfinished base slightly concave	-	-	4.5 mm	-	-
Grinding	n. a.	n. a.	sides and base	slightly at spurs	n. a.	n. a.	sides only	n. a.	n. a.
Grinding length	-	-	28 mm	-	-	-	>21 mm	-	-
Flute no.	1-0	1-2	1-1	1-0	1-1	1-0	1-2	0-0	1-0
Flute length	>57 mm	34.8, 12.8/34.8	26.5, 26.5	15.3	23.7, 23.7	7	19.3, 19.5/19.5	-	14.5
Flute width	16.2	13.2, 7.5/8.7	12.4, 14.2	12.8	14.6, 12.7	9	14, 8.1/8.7	-	12
Waisted base	-	no	yes	unfinished	-	-	yes	-	-
Remarks	broken in situ; unfinished	broken in situ; unfinished	used and discarded	unfinished	used and discarded	too small	used and discarded	broken in situ; unfinished	broken in situ; unfinished

*Measures of available portions of incomplete artifacts.

below since it is one of the most diagnostic attributes for establishing a typology and building a cultural chronology (see Bradley et al. 2008). Detailed attributes for each fluted point fragment are presented in table 7.2. Additionally, borrowing the method developed recently to understand fluted point variability at Debert (Ellis 2004), we compare these metric and morphological attributes with sets of points from adjacent regions. It is obvious that the fragmentary nature of our points must be emphasized; nevertheless, some measurements and morphological features are clear enough to be used convincingly in a comparative analysis.

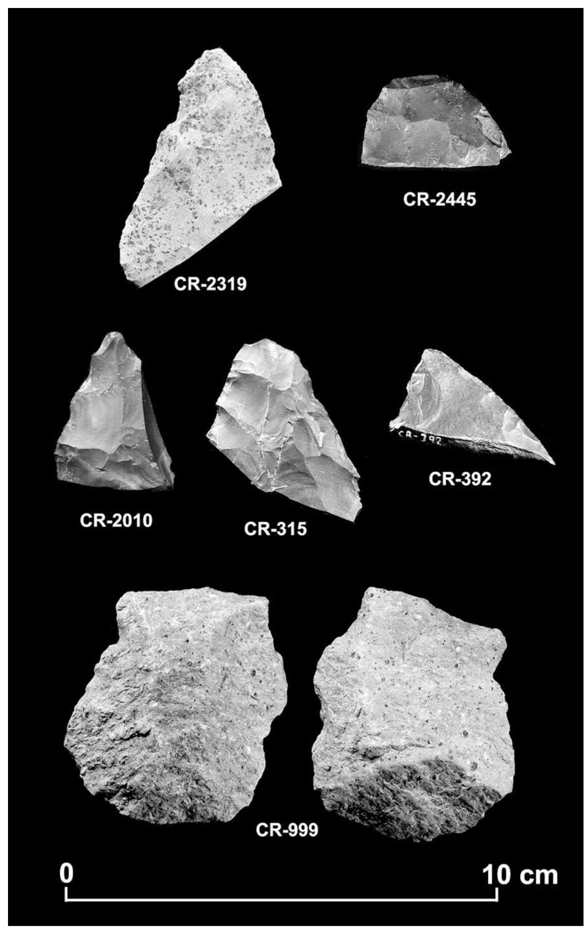
The stone used to produce these fluted points was identified by macro-observation and in some cases by professional archaeologists and geologists. A more detailed analysis should be attempted in the near future, using nondestructive approaches, but the two most important raw materials have been decisively identified: red Munsungun chert, and rhyolites from northern New Hampshire. Curiously, the Munsungun chert is dominant in the flake debitage, but only two fluted points, three if we include the nonfluted point, were made out of this excellent silicate (Pollock et al. 1999). The source is in northeastern Maine, 180 km in a straight line from the Cliche-Rancourt site. Three fluted point fragments are identified as green, gray, and black chert. The finished base made of a lustrous green-black chert (CR-267) could be a variety of the Munsungun source (S. Pollock, personal communication, August 2006). One base and two distal ends are made of rhyolite that has been

identified at two possible sources between Berlin (Mount Jasper) and Jefferson in northern New Hampshire (Pollock et al. 2008a, 2008b). This provenance is 120 km in a straight line from the Cliche-Rancourt site and in the opposite direction from the Munsungun source. These two sources, if exploited directly by the Cliche-Rancourt group, may have been the extremities of a large nomadic cycle of about 300 straight-line km, which could be more than 500 km when moving along geographic features.

Bifaces are rare and badly fragmented at Cliche-Rancourt. The only complete specimen is made of New Hampshire rhyolite (figure 7.5). It was found in seven pieces distributed within the center of the Early Paleoindian occupation of Area 1, and the recovery of only a few flakes of this material make it probable that this large tool was produced elsewhere. This biface is of a particular ellipsoidal cross-sectional shape produced by marginally retouching the edges. This type is recognized elsewhere as an alternately beveled biface (Ellis and Deller 2000:92–94). Curiously, the other 28 biface fragments are from various sections, but none is clearly from a base (figure 7.6). Except for one distal end of a large biface and two small lateral fragments made of New Hampshire rhyolite, the rest of the fragmented bifaces are made of red Munsungun chert. A crude preform made of an unknown rhyolite (CR-999) is tentatively included in this biface category and is the only bifacial specimen found in Area 3SE.

The individual morphometric descriptions of these fragmented bifaces are not very informative (see Chapdelaine 2007:77, Table 3.4, for specimens found in Areas 1 and 2). The 13 specimens found recently in Areas 3NW, 3SE, and 5 are briefly described here. The eight fragments collected from Area 3NW are two distal ends, one large midsection with only one edge, and five very small mesiolateral

7. 5. Large alternate beveled biface made of New Hampshire rhyolite, Cliche-Rancourt site.



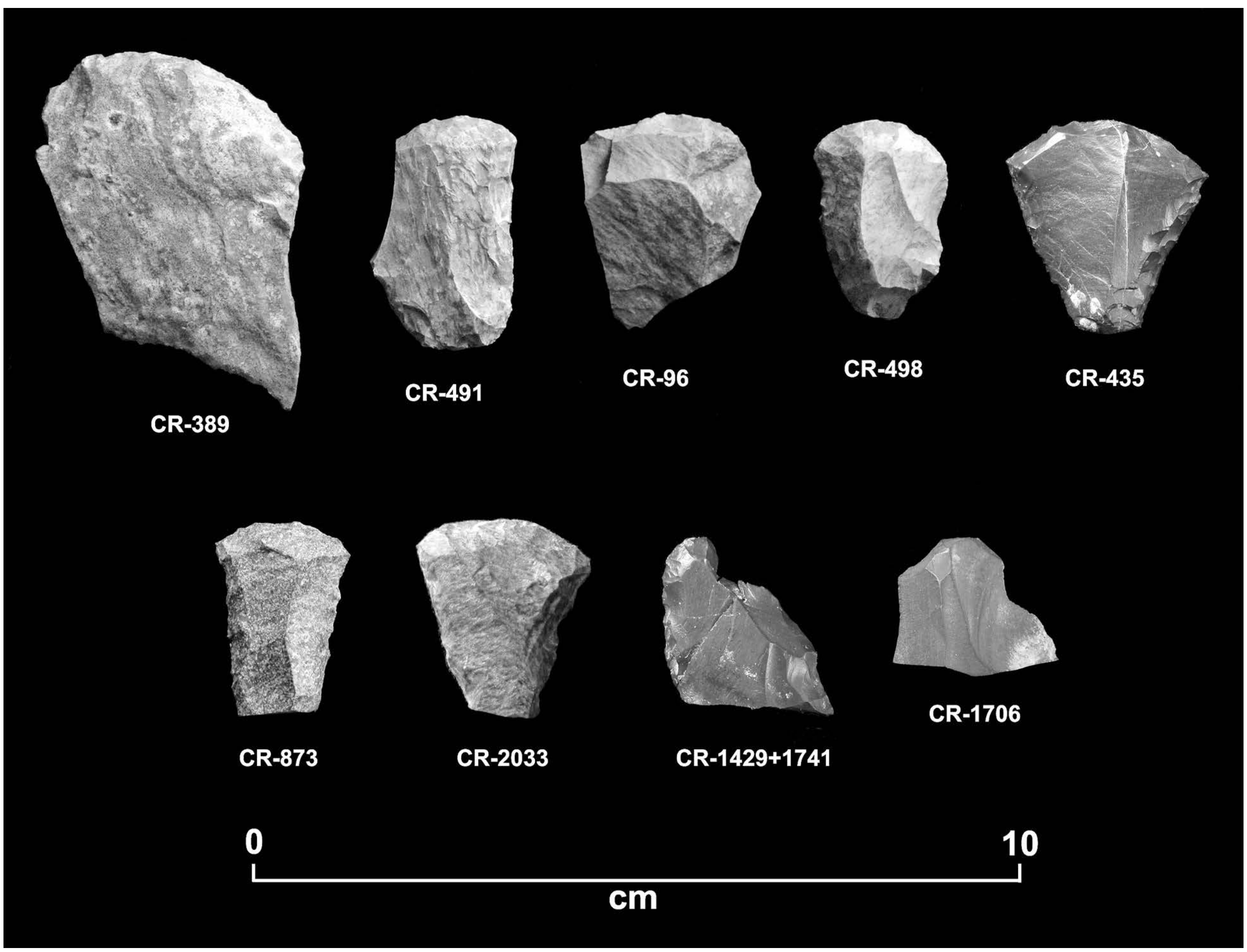
7.6. Biface fragments, Cliche-Rancourt site; all the specimens red Munsungun chert except CR-2319 and CR-999, which were produced from rhyolite of an unknown source.

fragments. These small fragments are not representative of the intensity of the working of red Munsungun chert in this area, considering that we have recovered 7,184 debitage flakes of this material. One explanation could be that the success rate is high for the knappers. It could also be argued that, since the flakes are small, the bifaces were produced elsewhere and brought to the site, where they were curated and occasionally transformed into projectile points or other tools. It is possible that some bifaces, broken during their maintenance or recycling, were discarded away from the work area and are located in the unexcavated periphery.

From Area 3SE, the single biface (CR-999) is a weathered preform of unknown rhyolite, and its workmanship is not informative (figure 7.6). It was found in the 25–30 cm arbitrary level of unit B-67, southwest quadrant. Few scars are discernable, the distal end shows a round curve, suggesting that it was originally a pebble, and the presumed base has one face unworked.

The single biface tip made of red Munsungun chert from Area 5 was first identified in the field as a base, but observations of major scars on both faces after careful cleaning indicate that it is more appropriately classified as a distal end (figure 7.6, CR-2445). A second biface (CR-2319) is a distal end of a large New Hampshire rhyolite biface (width, 49 mm). Two small mesiolateral fragments made of an unknown rhyolite with a surface area less than 200 mm^2 complete this small biface assemblage for Area 5.

Endscrapers are not common at the Cliche-Rancourt site. Six endscrapers are made of New Hampshire rhyolite and three of red Munsungun chert (figure 7.7). The working edge is always convex in plan view, and five specimens exhibit spurs at the end of the working edge (table 7.3).



7.7. Endscrapers, Cliche-Rancourt site: CR-435, CR-1429+1741, and CR-1706 are red Munsungun chert; the others, New Hampshire rhyolite.

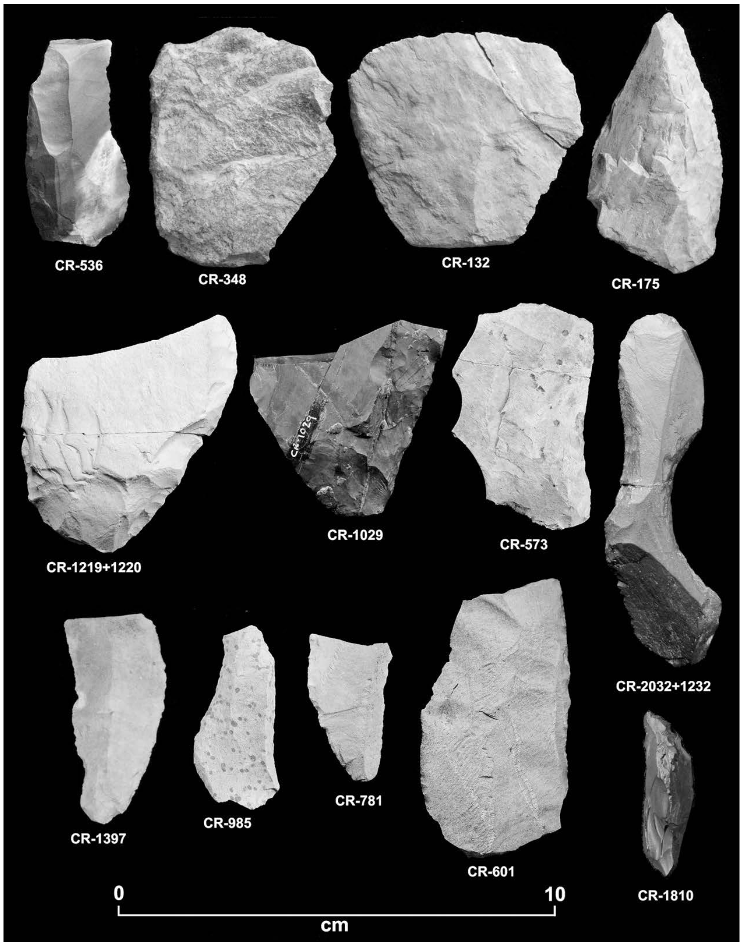
Table 7.3. Endscraper Attributes, Cliche-Rancourt Site

Artifact No.	*Area*	*Unit*	*Level (cm)*	*Condition*	*Material*	*Length (mm)*	*Width (mm)*	*Thickness (mm)*	*Thickness working edge (mm)*	*Width working edge (mm)*	*Striking platform*	*Remarks*
CR-435	1	G-72	25–30	complete	Munsungun chert	28.5	26.8	6.6	5.9	26.8	grinding	two short spurs used
CR-498	1	H-74	20–25	complete	New Hampshire rhyolite	25.3	17.3	5.3	4.6	17.3	uniform	less-developped spurs but used
CR-491	1	H-72	15–20	considered complete	New Hampshire rhyolite	30.6	18.6	4.7	4.4	>20	faceted	one spur used, the other broken
CR-389*	1	i-72	40–45	incomplete in width	New Hampshire rhyolite	47.9	>35	5.6	3.6	>35	absent	opposite working edge used on both faces
CR-96	1	i-71	55–60	incomplete	New Hampshire rhyolite	28.6	>26	7.5	5.6	>26	absent	irregular working edge but used
CR-2033	3	C-67	30–35	complete	New Hampshire rhyolite	26.1	23	4.6	3.9	23	absent	two short spurs used
CR-871	3	AT-62	20–25	complete	New Hampshire rhyolite	25.7	18	5.5	5.1	18	absent	two short spurs used
CR-1706	3	AU-63	0–10	incomplete	Munsungun chert	>19	>22	5.9	3.5	14	absent	irregular working edge
CR-1429+ 1741	3	AS-62, AT-61	25–30, 65–70	incomplete	Munsungun chert	>27	>19	>5.1	3.7	16	absent	incomplete working edge; also a sidescraper

*This endscraper could also be a sidescraper, because the working edge is on the lateral side. It is considered an endscraper because of the well-developed, convex, steeply retouched working edge.

Two endscrapers (CR-2033 and CR-873) made of New Hampshire rhyolite had their striking platforms snapped. Lateral edges have been marginally retouched on six specimens. All the endscrapers could be classified in the small to midsize range, with the working edge varying between 17 and 27 mm except for CR-389, which is much bigger (>35 mm) and has an adjacent edge retouched and was used as a sidescraper.

The second type of unifaces, the sidescrapers, is more frequent, with a total of 29 (figure 7.8). Since the initial description of nine sidescrapers found in Areas 1 and 2 (Chapdelaine 2007:78–80), 20 new implements coming from Areas 3NW, 3SE, and 5 have been added. The new sidescrapers are in poor condition, with only four complete specimens (table 7.4). Most of the sidescrapers are made of New Hampshire rhyolite (n = 15) and chert (n = 14), and a group of six rhyolite specimens found in Area 3SE could eventually be identified as weathered chert. The shape of the working edge is generally straight, but one specimen has a concave working edge (CR-985) and another is a double



7.8. Sidescrapers, Cliche-Rancourt site: CR-536, CR-1029, CR-2032+1232, and CR-1810 are red Munsungun chert; the others, New Hampshire rhyolite.

concave sidescraper (CR-2032+1232). Specimen CR-1029 is an alternate double sidescraper. The few complete sidescrapers were shaped on large flakes with faceted striking platforms, occasionally crushed and grounded. The poor condition of most sidescrapers indicates that they were used at the site and discarded after breakage.

A third type of uniface found on several Early Paleoindian sites, the limace, is not yet formally identified at the Cliche-Rancourt site. A single specimen found in two fragments, classified as an endscraper (CR-1429+1741), could also be a sidescraper (see figure 7.7). The working edge is narrow, 16 mm, the thickness is within the tool range of sidescrapers, and the sides are not steep enough to allow recognition of the distal end of a limace. The length of this specimen in unknown, and the limace or chisel type of scraping tool (Gramly 1990:32) is therefore considered absent from our tool assemblage.

Gravers are also a common type of uniface. They could be easily made on any type of debitage flake, the only critical factor being presumably the thickness of a particular edge. The spur is usually created by taking out very small flakes on both sides of the intended spur. The projection of the spur from the flake edge varies, as does the number of these small spurs on a single flake (figure 7.9; table 7.5). The total number of gravers is 27, including CR-1810, which is included in the sidescraper category (see figure 7.8). The gravers generally have one spur (*n* = 19), but two spurs (*n* = 6) and three spurs (*n* = 2) are also present. Most of the spurs are well made, but some were produced quickly with few retouches. The thickness of these spurs, although difficult to estimate with precision, averages 1.5 ± 0.3 mm. Only four specimens have a spur thicker than 1.8 mm. Variability exists in this category, and eventually it will be useful to undertake trace wear analysis and refine this tool class. These items are made of selected flakes, and one is a channel flake. The size of these flakes varies from 300 to 700 mm^2, with only four being on larger flakes. Eighteen gravers were made of red Munsungun chert, six of New

Table 7.4. Sidescraper Attributes, Cliche-Rancourt Site

Artifact No.	*Area*	*Unit*	*Level (cm)*	*Condition*	*Material*	*Length (mm)*	*Width (mm)*	*Thickness (mm)*	*Thickness working edge (mm)*	*Length working edge (mm)*	*Striking platform*
CR-99	1	K-73	15–25	incomplete	New Hampshire rhyolite	>29	20.5	6.8	4.9	>27	absent
BiEr-14.7	1	#55	Ae in B (15–25)	incomplete	New Hampshire rhyolite	>18	16.7	4	3.4	>16	absent
CR-175	1	K-74	15–25	complete	New Hampshire rhyolite	59.2	30.6	7.1	4.5	56.6	flat
CR-132	1	J-74	15–25	complete	New Hampshire rhyolite	48.5	51.8	9.5	4.2	43.6	flat
CR-464	2	M-54	25–30	complete	New Hampshire rhyolite	64	56.6	18.4	8	±43	absent
CR-348	1	G-73	35–40	complete	New Hampshire rhyolite	55.8	43.9	6.5	3.2	49.6	flat
CR-362	1	J-71	30–35	incomplete	Munsungun chert	>12	>11	>4.4	3.1	n. m.	absent
CR-536	2	O-53	0–10	complete	Munsungun chert	47	24.1	4.5	4.3	35.2	faceted
CR-573	1	i-74	25–30	complete	New Hampshire rhyolite	50.1	30.2	5.5	4.5	42.1	faceted
CR-601	3SE	B-68	30–35	complete	New Hampshire rhyolite*	62.7	34.9	6.6	3.1	46.7	faceted
CR-608	3SE	B-68	25–30	incomplete	New Hampshire rhyolite*	-	-	5.5	2.6	n. m.	absent
CR-613	3SE	B-68	15–25	incomplete	gray chert	-	-	-	2.7	n. m.	absent
CR-724	3NW	AR-61	40–45	incomplete	Munsungun chert	>29	41	16.6	?	>17	absent
CR-781	3SE	AZ-67	15–20	incomplete	New Hampshire rhyolite*	>34	19.4	4.5	2.8	>29	absent
CR-985	3NW	AT-62	35–40	complete	New Hampshire rhyolite	43	20.4	5.6	2.5	39.6	faceted
CR-1029	3NW	AT-62	40–45	incomplete	Munsungun chert	45.4	43.2	11.9	5.6, 5.4	>44.3, >41.3	faceted and ground

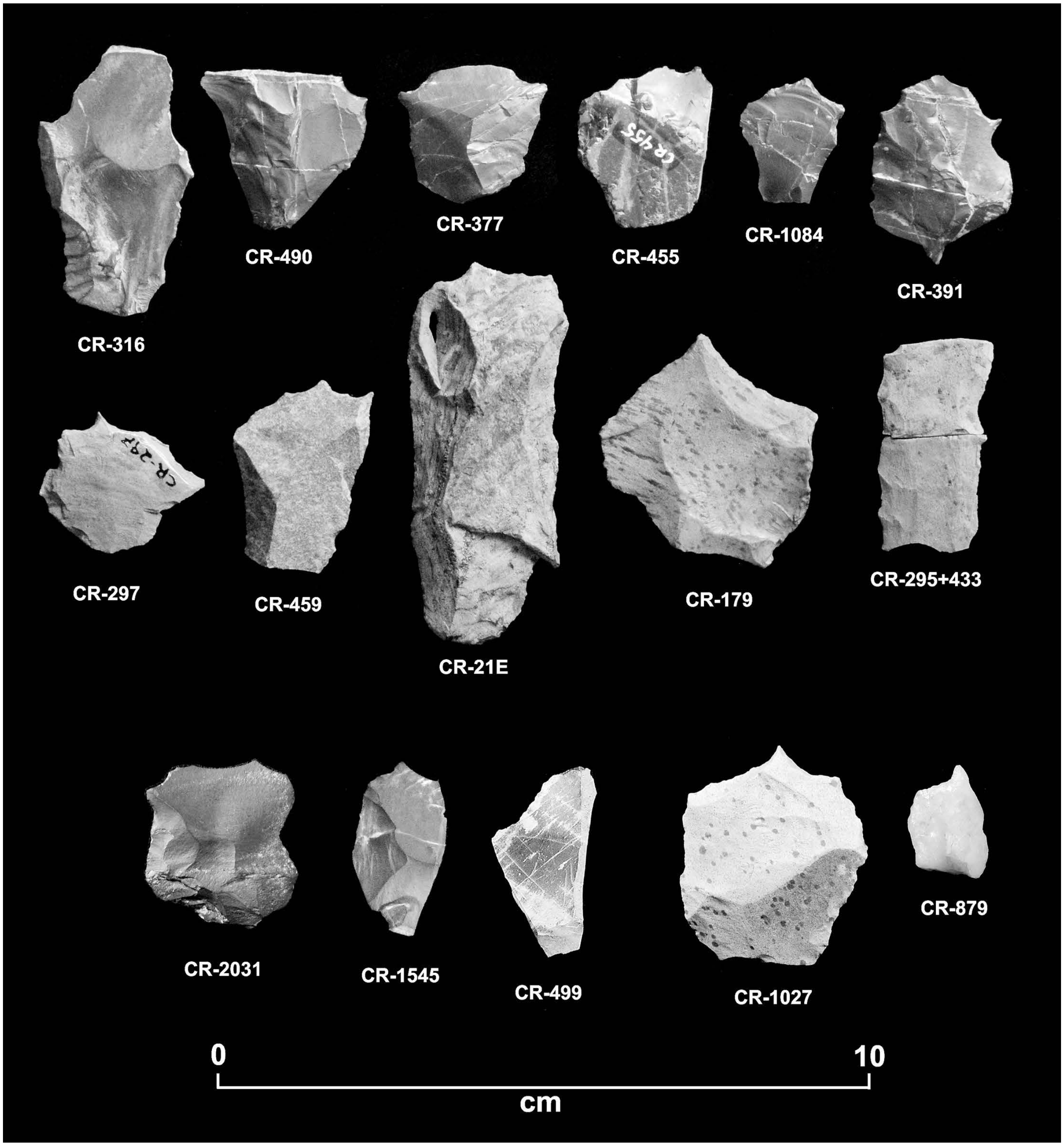
Table 7.4. *continued from previous page*

Artifact No.	*Area*	*Unit*	*Level (cm)*	*Condition*	*Material*	*Length (mm)*	*Width (mm)*	*Thickness (mm)*	*Thickness working edge (mm)*	*Length working edge (mm)*	*Striking platform*
CR-1099	3NW	AU-60	15–20	complete	Munsungun chert	39.7	16.5	7.5	4.1	21.3	flat
CR-1219 + 1220	3SE	AY-68	20–25, 25–30	incomplete	New Hampshire rhyolite*	>57.6	49.7	11	4.7	>54.6, >32.5	faceted and crushed
CR-1305	3SE	B-66	30–35	incomplete	New Hampshire rhyolite*	>21.5	29.6	5.3	1.9	>21	flat and crushed
CR-1395	3SE	AZ-68	0–10	incomplete	Munsungun chert	>36	38.3	8	2.4	>17	absent
CR-1397	3SE	AZ-68	0–10	incomplete	New Hampshire rhyolite*	>48.4	22.5	5.8	2.3	>46	flat and crushed
CR-1427	3NW	AT-61	65–70	incomplete	Munsungun chert	>22	>15.5	5.8	2.3	>18	absent
CR-1546	3SE	AY-70	25–30	incomplete	Munsungun chert	>30	>11	>5	4.3	>30	flat
CR-1810	3NW	AS-63	15–20	incomplete	Munsungun chert	38.8	11.5	7.3	1.8	>34	absent
CR-2032 + 1232	3SE	C-67 B-67	30–35 40–45	complete	Munsungun chert	83.7	21.3	5.6	5.1, 4.6	35.2	flat and crushed
CR-2493	3SE	D-66	35–40	incomplete	New Hampshire rhyolite	n. m.	n. m.	n. m.	n. m.	n. m.	absent
CR-2405	5	Q-120	25–30	incomplete	green chert	>18	>26	5.4	2.6	>12	absent
CR-2322	5	Q-120	20–25	incomplete	Munsungun chert	>32	>21	>5.1	4.2, 3.6	>18, >17	absent
CR-2377	5	Q-121	30–35	incomplete	Munsungun chert	>40	>20	10.6	4.1	>35	absent

*This material is weathered to a mat, gray-beige color with no visible inclusions; it could be a chert.

Hampshire rhyolite, two of quartz, and one of a weathered beige chert. This tool class was popular during the Early Paleoindian period, and its presence at the Cliche-Rancourt site confirms the domestic nature of the occupation.

Wedges are known on Early Paleoindian sites, but their presence is not widespread. The tool is generally defined as resulting from the recycling of broken tools or the use of small bipolar cores. At the Cliche-Rancourt site, not a single specimen could be unequivocally identified as a wedge, or pièce esquillée. One thick piece of red Munsungun chert was identified tentatively as a pièce esquillée (figure 7.10). Found in Area 2, CR-571 is a cortical red Munsungun flake (ca. 400 mm^2) classified as a utilized flake, but a dihedral fracture along with scars at opposing edges alternately suggests a wedge or an exhausted bipolar core. A single possible wedge made of quartz was found in level 10–15 cm from unit V-72 of Area 1. It is a split pebble with one edge showing limited use wear. The identification of this tool as a



7.9. Gravers, Cliche-Rancourt site: upper row except CR-316 and the first three specimens of the lower row, red Munsugun chert; CR-316, a green chert; CR-879, quartz; the remainder, New Hampshire rhyolite.

wedge remains uncertain, and the low quality of this quartz is puzzling in this presumed Early Paleoindian occupation. Crystal quartz is more common on sites of this cultural horizon (Gramly 1988).

Area 3 of Cliche-Rancourt produced seven wedges or possible candidates for this elusive tool category. Only one red Munsungun chert flake is identified as a wedge. Found in the 35–40 cm level of unit AV-62, this large quadrangular flake (ca. 800 mm^2) has use wear on its four edges (figure 7.10, CR-941). It is definitely a utilized flake and a strong candidate as a pièce esquillée. A less probable candidate is a quadrangular gray shale flake showing scars at opposite edges (CR-578). If it was a wedge, it was not used intensively. The remaining five specimens are made of

Table 7.5. Graver Attributes, Cliche-Rancourt Site

Artifact No.	*Area*	*Unit*	*Level (cm)*	*Condition/ surface (mm)*	*Material*	*Length (mm)*	*Width (mm)*	*Thickness (mm)*	*No. spur*	*Spur thickness*	*Striking platform*
CR-316	1	K-75	15–20	complete 800–1000	Munsungun chert	42.3	25.6	2.5	2	1.7	absent
CR-21E	1	J-73	25–30	complete >1,400	New Hampshire rhyolite	59.7	24.8	8.3	2	1.65	faceted
CR-1084	1	i-71	55–60	complete 200–300	Munsungun chert	20.3	16.2	2.6	2	1.4, 1.3	faceted
CR-490	1	i-71	35–40	incomplete 400–600	Munsungun chert	25.3	26	3	1	1.2	faceted and ground
CR-459	1	G-74	30–35	complete 400–600	New Hampshire rhyolite	30.3	20.7	6.1	3	2.1, 1.9, 1.3	flat
CR-297	1	H-74	25–30	complete 300–400	New Hampshire rhyolite	20.2	23.5	2.1	1	1.5	faceted
CR-179	1	K-72	15–25	complete 800–1000	New Hampshire rhyolite	33.6	30.3	3.9	1	1.7	faceted and ground
CR-377	1	H-72	40–45	complete 400–500	Munsungun chert	21.8	23.4	6.1	2	1.9, 1.7	irregular with cortex
CR-391	1	i-72	25–30	cons. complete 400–600	Munsungun chert	29.2	22.1	3.2	2	1.4, 1.3	absent
CR-455	1	i-71	45–50	cons. complete 400–600	Munsungun chert	23.8	23.7	5.6	1	1.5	faceted
CR-295 + CR-433	1	J-72	20–25	cons. complete 500–600	New Hampshire rhyolite	33.6	18.3	1.5	1	1.3	absent; channel flake
		N-71	20–25								
CR-499	3SE	AY-68	20–25	complete 300–400	Munsungun chert	30.1	15.4	5.6	1	1.4	flat with cortex
CR-866	3NW	AT-62	20–25	cons. complete ±600	Munsungun chert	29.7	24.7	5.1	1	1.1	broken
CR-879	3SE	A-68	25–30	complete 200	quartz	17.1	12.2	7.1	1	2.7	absent
CR-1027	3NW	AT-62	45–50	complete 800–900	New Hampshire rhyolite	33.7	28.9	4.1	3	2.1, 1.8, 1.6	broken
CR-1129	3NW	AU-60	15–20	complete 600–700	weathered beige chert	24.2	36.9	7.1	1	1.2	flat
CR-1545	3SE	AY-70	35–40	incomplete >400	Munsungun chert	>15	27	6.1	1	1.35	absent
CR-1847	3NW	AS-62	35–40	complete 400–500	Munsungun chert	19.8	29.6	3.7	1	1.1	faceted
CR-1849	3NW	AS-62	35–40	complete ±600	Munsungun chert	30	23.5	3.7	1+	1.3	faceted and ground

Table 7.5. *continued from previous page*

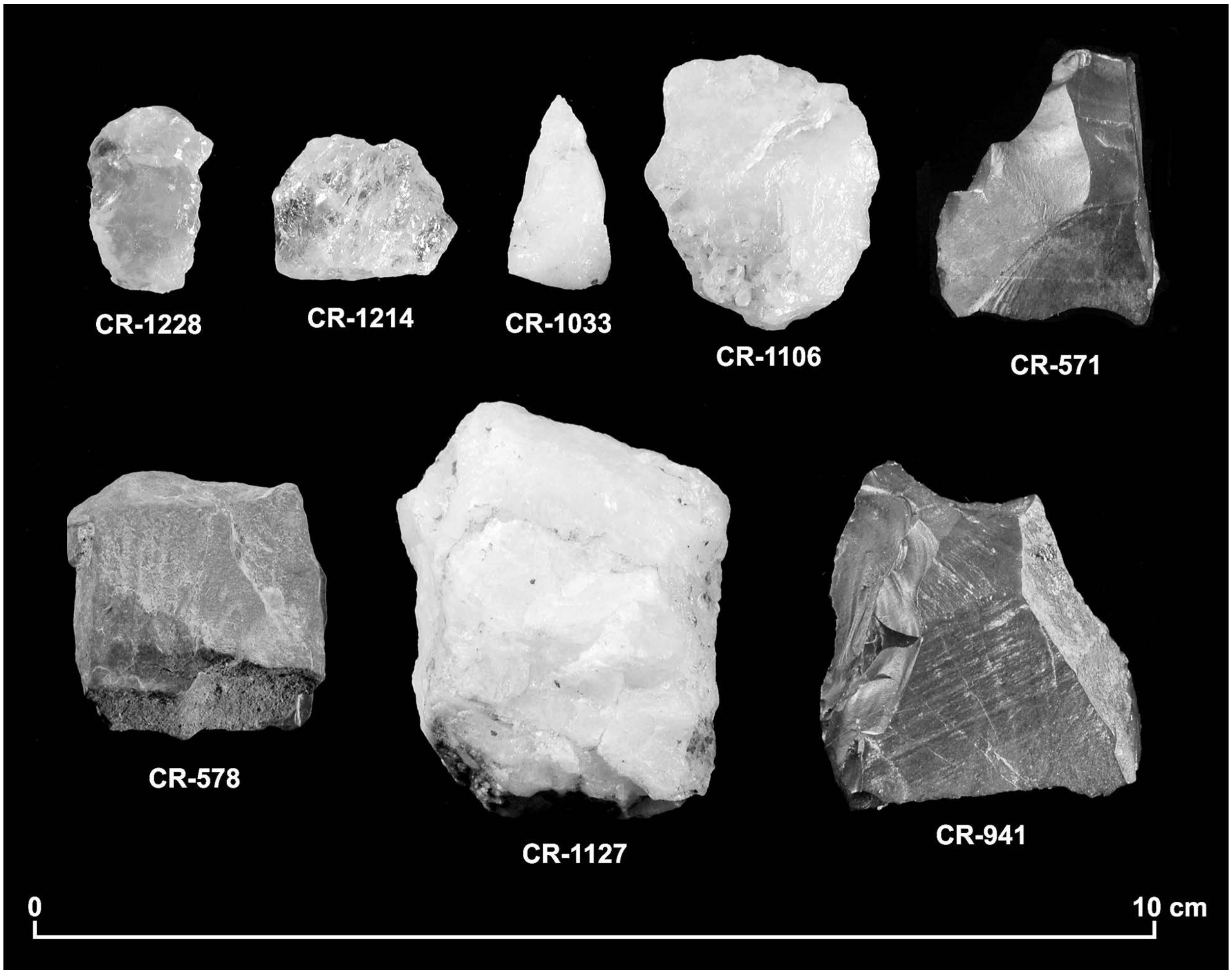
Artifact No.	*Area*	*Unit*	*Level (cm)*	*Condition/ surface (mm)*	*Material*	*Length (mm)*	*Width (mm)*	*Thickness (mm)*	*No. spur*	*Spur thickness*	*Striking platform*
CR-1888	3NW	AS-63	25–30	incomplete >600	Munsungun chert	>24	25.2	5	1	1.5	absent
CR-2030	3SE	C-67	35–40	incomplete >400	Munsungun chert	>24	25.8	2.4	2	1.6, 1.1	absent
CR-2031	3SE	C-67	30–35	complete 600–700	Munsungun chert	27.6	24	3.8	1	1.5	faceted and crushed
CR-1810*	3NW	AS-63	15–20	incomplete >400	Munsungun chert	38.8	11.5	7.3	1	1.8	absent
CR-2494	3NW	AQ-62	30–35	complete 200–300	Munsungun chert	21.2	16.2	2.1	1	1.3	faceted
CR-2488	3SE	D-66	35–40	incomplete >50	Crystal quartz	>7.5	>4.4	>2	1	1.8	absent
CR-2274	5	Q-121	0–10	complete 600–700	Munsungun chert	35.3	28.6	2.8	1	1.7	absent
CR-2446	5	Q-121	30–35	complete ±400	Munsungun chert	23.2	21.9	4.7	1	1.4	absent

*This specimen is also considered in the sidescraper category.

quartz. Two small pieces of crystal quartz (<200 mm^2) are heavily battered, but they lack wedge attributes since they show no blunt edge (CR-1228 and CR-1214). They are both heavily used but their function is not known. The other three wedges are made of vitreous quartz. One is quite large (1,300 mm^2), the second is of medium size (ca. 400 mm^2), and the third is a small fragment with typical dihedral fractures of a good vitreous quartz (CR-1127, CR-1106, CR-1033). Again, we are not convinced that the quartz implements are associated with the Early Paleoindian occupation. As for the two red Munsungun chert pieces, they could also be considered a bipolar core in one instance and a heavily utilized flake in the other. The presence of unequivocal wedges at the Cliche-Rancourt site is not yet settled, and their absence or scarcity may be an indication of the site's chronological position (see Ellis and Deller 1997).

Utilized flakes are common on Early Paleoindian sites, but their analysis seems less detailed when the bifacial and formal unifaces such as endscrapers and sidescrapers are well represented. Their description is sometimes sketchy. Curiously, the tool inventory at Vail does not include utilized flakes (Gramly 1982), but hundreds of cutters, wedges, and thousands of flakes were identified. At Debert, utilized flakes are named "flake tools with marginal retouch," and they account for more than a thousand specimens (MacDonald 1968:101). At Michaud the retouched and utilized flakes were lumped together (Spiess and Wilson 1987:71–72), and this is also what we did. This tool class is the dominant one at both Michaud and Cliche-Rancourt, representing, respectively, 50 percent and 72 percent of tools. The ratio of flakes per utilized flake at Michaud is 1:21 (1,462/70), at Cliche-Rancourt 1:39 (11,176/288). The ratio for Area 1 at Cliche-Rancourt is very similar to that at Michaud, with 1:20 (1,151/57), and ratios for Areas 3NW (1:43), 3SE (1:33), and 5 (1:49) are quite different.

The number of utilized flakes at Cliche-Rancourt is significant, and they are worthy of serious attention. In fact, their exact number for Area 3NW must await an upcoming thorough analysis of the 7,000-plus flakes, which may lead to the discovery of more utilized flakes. The formal analysis of utilized flakes that follows deals with the problem of distinguishing edge-damage flakes caused by natural or modern factors from the use wear characteristic of this tool type. Continuous versus discontinuous use scars guide us through this analysis where few truly retouched flakes were registered.



7.10. Wedges, or pièces esquillées, Cliche-Rancourt site: CR-1228, CR-1214, CR-1033, CR-1106, CR-1127, quartz; CR-571, CR-941, red Munsungun chert; CR-578, a dark gray slate.

Most of the utilized flakes could be identified through visual inspection of cleaned edges. To ensure the validity of this tool category, all candidates were carefully examined with a 4x lens and sometimes with a 10x lens. The use of a binocular microscope was not necessary for identification since the utilized portion of a flake must be visible to a trained eye to be considered. However, a detailed use wear analysis with high-power microscope could expose very small strias and polishes and give us more information about function. Such a study will have to wait, but considering the number of tools in this category it is promising.

Several utilized flakes are complete, and they were selected from large flakes. The morphometric features of utilized flakes from Areas 1, 2, 3NW, and 3SE are presented in table 7.6. One interesting feature is the location of the use wear on the ventral surface of 96 specimens (40 percent), whereas the dorsal side was used 215 times on 241 specimens (89 percent). Interestingly, my new analysis of utilized flakes from Area 3NW confirms my former analysis of utilized flakes from Area 1 published in 2007. In both samples, the two patterns are similar: 54.4 percent of utilized flakes with a continuous scar pattern for Area 1, and 54.8 percent for Area 3NW. This shows not only the consistency of the analyst but also that we are dealing with the same general type of flakes, the same thickness, and comparable intensity of use.

The format of utilized flakes varies, and the fragmentary nature of the collection renders the task difficult. Nonetheless, 24 of the 208 analyzed specimens have a surface less than or equal to 200 mm^2, 100 specimens are between 200 and 400 mm^2, and 84 utilized flakes have a surface size over 400 mm^2, of them 18 larger than 800 mm^2. The striking

Table 7.6. Utilized Flake Attributes by Area, Cliche-Rancourt Site

Utilized flakes/area	*1*	*2*	*3NW*	*3SE*	*Total*
n	57	3	168	13	241
Munsungun chert	50	3	163	6	222
New Hampshire rhyolite	5	0	1	6	12
other material	2	0	4	1	7
with a striking platform	29	2	104	5	140
surface <200 mm^2	2	0	19	3	24
surface 200–400 mm^2	12	2	81	5	100
surface 400–800 mm^2	6	0	57	3	66
surface >800 mm^2	5	0	11	2	18
left side	10	0	33	3	46
right side	15	1	33	1	50
distal end	11	1	23	3	39
more than one edge	17	1	78	6	102
dorsal use	50	2	150	13	215
ventral use	21	3	70	2	96
dorsal and ventral	14	2	52	2	70
thickness average	4.25 mm	-	4.16 mm	4.07	-

platform is visible on 140 utilized flakes. The faceted variety is dominant, with 63 percent (88/140), followed by flat (21 percent), dihedral (12 percent), and irregular (4 percent).

The utilized flakes are used invariably on the right side (n = 50), the left side (n = 46), the distal end (n = 38), or on more than one edge (n = 102). The position is undetermined on five specimens. Specimens from Area 3NW are more often used on more than one edge (78/168, 46.4 percent), compared to 30 percent (17/57) for Area 1.

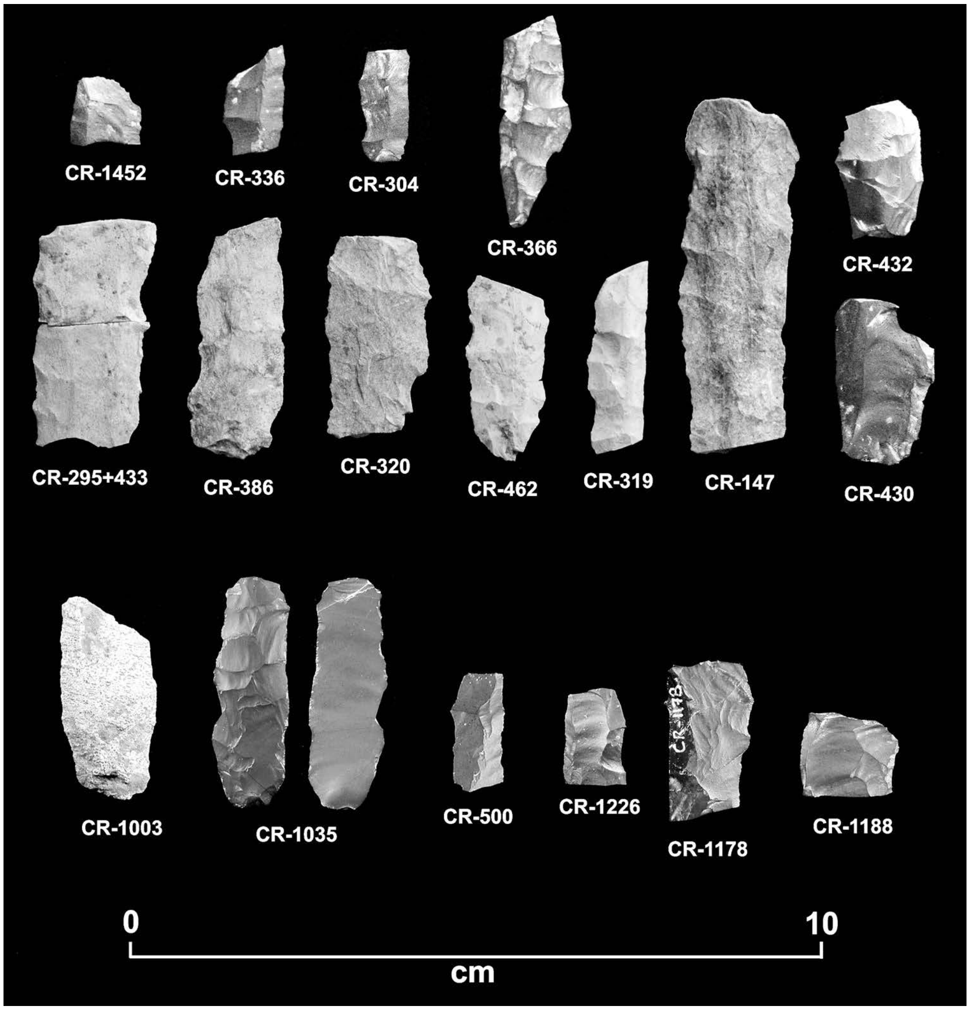
The utilized flakes from Area 1 were used more often on the dorsal side (n = 50, 88 percent) but also on the ventral side (n = 21, 37 percent) or both (n = 14, 25 percent). For Area 3NW, the dorsal side was also preferred (n = 150, 89 percent), though the ventral side was not neglected (n = 70, 42 percent), and the simultaneous use of both sides occurred 52 times (31 percent). Red Munsungun chert was preferred (222/241, 92 percent), and only Area 3SE shows a marked contrast, with New Hampshire rhyolite being as popular as the red chert.

The popularity of these utilized flakes at the Cliche-Rancourt site is probably linked to domestic activities such as cutting, scraping, and sawing various materials but also to substituting for endscrapers, thus saving the latter for future use elsewhere on the journey. Utilized flakes were used once for a short period and then discarded. They are a good indicator of an occupation's intensity and duration—in this case a short but intense stay to refurbish hunting gear, work hides and other materials, and leave behind more than 8,000 lithic flakes.

The number of utilized flakes is thus related to the intensity of occupation, which seems to be linked to the total number of lithic flakes. The distinct ratios from Areas 1 and 3NW are indicative of this tendency. There are nearly seven times more flakes and three times more utilized flakes from Area 3NW than from Area 1. Unfortunately, this tendency is not linked to bifacial tools, where the opposite was observed, with two times more bifacial tools from Area 1 than from Area 3NW.

FLAKE DEBITAGE

The abundant class of flake debitage comprises three types of cultural remains: channel flakes, cores, and flakes. The number of channel flakes is firmly defined for Areas 1 and 2, but the exact number for Area 3 must await a detailed analysis. Identified in the field, the 31 channel flakes from Area 3 are added to the 12 specimens from Areas 1 and 2. This type of artifact has been used successfully to determine the type of fluted point and the corresponding chronological phase (Boisvert 2008). The identification of channel flakes



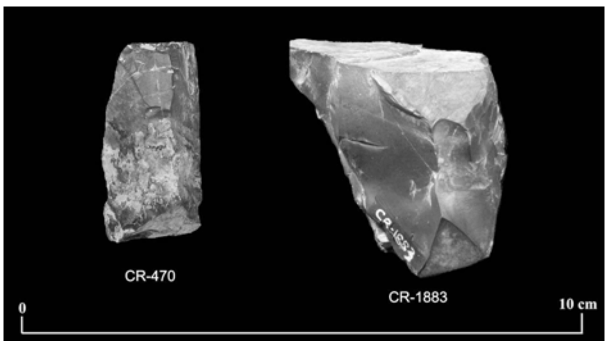
7.11. Channel flakes, Cliche-Rancourt site: upper row, red Munsungun chert; middle row, New Hampshire rhyolite, except CR-432, CR-430, red Munsungun chert; lower row, CR-1003, New Hampshire rhyolite, the others, red Munsungun chert.

in four loci indicates that the final stage of fluted point preparation was carried out at the site, and this activity was important in Areas 1 and 3NW. Most of the channel flakes are of red Munsungun chert, but several specimens are of the New Hampshire rhyolite (figure 7.11). The width varies between 8 and 18 mm, but the length is difficult to assess since only four channel flakes are considered complete. The visible striking platform is always faceted. Among the utilized flakes are 13 channel flakes, and one channel flake was used to make a graver. Of note, nine channel flakes exhibit an anterior fluted scar that is narrower, and these could be secondary channel flakes. The single fluted scar on one face is not the rule, as shown by these channel flakes, and the purpose may have been to cover more than 50 percent of the point length with this particular procedure. In fact, two fluted point base fragments, CR-131 and CR-1036, show more than one channel flake scar on the same side. In addition, two channel flakes mend with a distal end and with the base fragment with the outrepassé flake, respectively. In both cases, the distance in the field between the mended fragments was less than 100 cm.

Cores are scarce at Cliche-Rancourt. A single specimen was found in Area 1, and only five were identified among the 7,000-plus flakes of Area 3NW. In that sector, only one core is of good size, the other four being small fragments of broken pieces showing at least three flaked sides, probably remnants of the bipolar use of these diminished cores. All of these cores are of red Munsungun chert (figure 7.12). The scarcity of cores in Area 3NW could be explained by the very small size of flakes, the near absence of cortical flakes,

and the fact that red Munsungun chert was brought to the site as an exotic material already in the shape of finished tools. The small number of cores is thus explained by the rationale that, the farther away the source, the more specialized tools are transported and kept rather than unfinished tools and blocks of raw material.

At the Cliche-Rancourt site, the vast majority of flakes are very small and of red Munsungun chert. The analysis of flakes from Area 1 indicates that 70 percent are smaller than 100 mm^2 in surface area (Chapdelaine 2007:85–87). Observations in the field during the excavation of Area 3NW clearly support a similar percentage, and the use of wet screening in 2008 (still to be analyzed) might provide even a larger figure. When the striking platform is present, the faceted variety dominates. It is clear that flakes of red Munsungun chert are mostly associated with the last stage of bifacial reduction, including the finishing, refitting, and recycling of working edges. The eventual detailed analysis of flakes from Area 3NW will be useful when compared to the sample already analyzed from Area 1. This description and comparison should help us define knapping and maintenance activities at the Cliche-Rancourt site.



7.12. Nuclei or cores on red Munsungun chert, Cliche-Rancourt site.

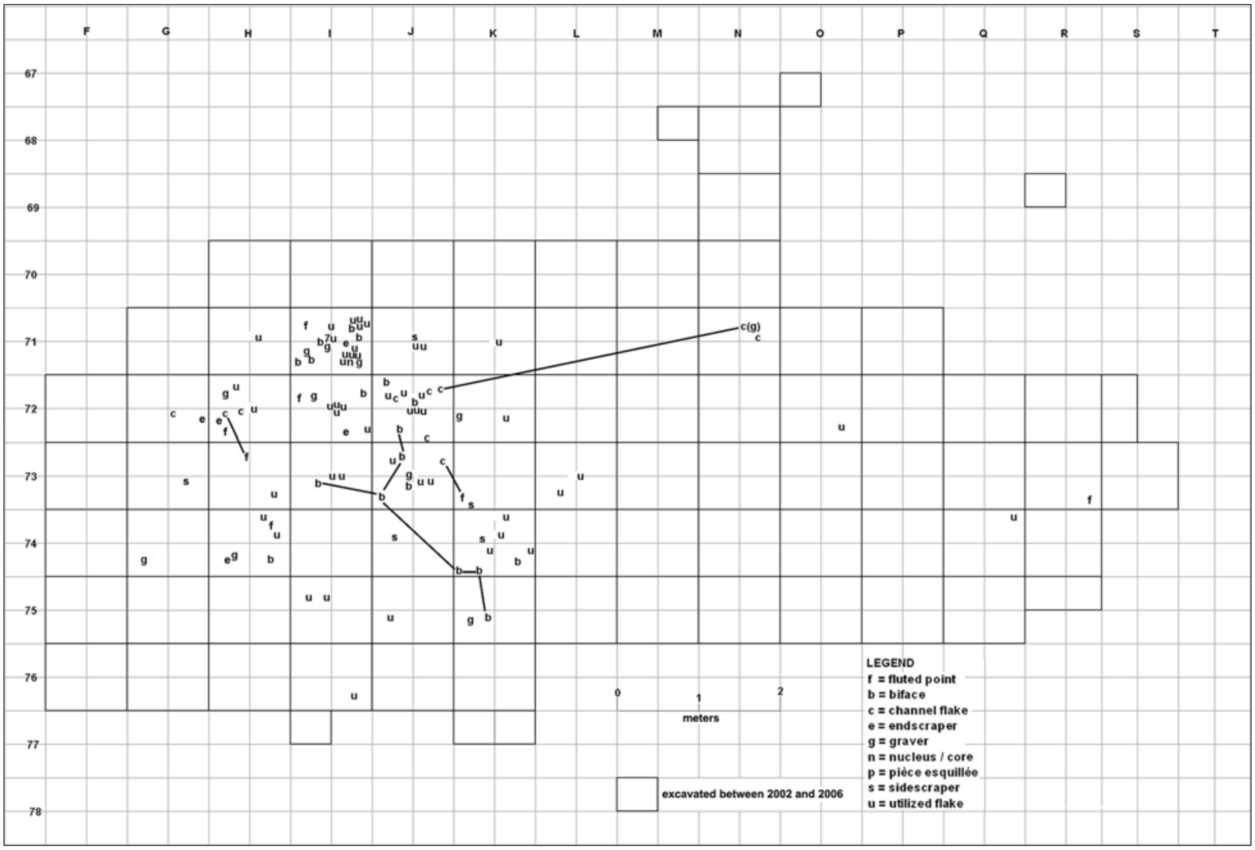
INTERNAL ORGANIZATION AND DOMESTIC ACTIVITIES

From an intrasite perspective, the four loci (Areas 1, 2, 3NW, 3SE) could correspond to distinct occupations that may or may not be coeval. This horizontal separation is similar to that seen in the vast majority of sites of this period and is clearly important if we are to understand the internal spatial organization of the site. The four areas are not of the same size or artifact density. The artifact distributions allow surface estimates for each locus: 50 m^2 for Area 1, about 5 m^2 for Area 2, 40 m^2 for Area 3NW, and 30 m^2 for Area 3SE (table 7.7). Between these loci the artifact density is zero, but there were isolated finds on the periphery, such as a fragmented biface found under a tree

Table 7.7. Lithic Distribution in the Five Areas of the Cliche-Rancourt Site

Tool Type	*1*	*2*	*3NW*	*3SE*	*5*	*Total*
Points	7	0	2	0	0	9
Bifaces	13	3	8	1	4	29
Endscrapers	5	0	3	1	0	9
Sidescrapers	7	2	6(7)*	11	3	29
Gravers	11	0	7	7	2	27
Wedges	1?	1	6***	2***	1	11
Utilized flakes	57	2	168	13	48	288
Total tools	101	8	200	35	58	402
Nucleus	1	0	4	1	0	6
Flakes	1151	48	7,184	429	2,364	11,176
Ratio debitage/tool	11.4	6	35.9	12.3	40.8	27.8
Ratio debitage/tool**	26.8	9.6	276.3	21.5	236.4	108.5
Total	1,252	56	7,449	471	2,422	11,578

*A sidescraper was classifed as an endscraper after mending.
**Tools considered are points, bifaces, endscrapers, sidescrapers, and gravers.
***Two specimens, one from each sector, are more likely battered cristal quartz than wedges.



7.13. Tool distribution in Cliche-Rancourt Area 1.

throw. The boundaries of these loci are clear, considering the low density observed in the peripheral areas. In each locus, a concentration has been identified, although Area 3NW was probably the theater of more than one knapping episode, with at least three lithic concentrations.

Area 1 is not large, but about 50 m^2 was littered with lithic tools and debitage (figure 7.13). This area could be enough to accommodate an economic unit of two families, based on ethnographic examples (Henriksen 1973; Mailhot 1993). It is difficult to imagine the exact location of their tents, but the two families may have shared a shelter. The tool distribution is much more extensive than the debitage concentration. The area could thus correspond to a small workshop in which tools were finished and curated and specific implements were used in domestic activities. The small concentration in the eastern portion of the excavated area is reminiscent of Area 2 by its size and the limited number of tools, although a fluted point fragment was recovered.

The dominant feature of Area 1 is the presence of seven fluted point fragments. Six were concentrated in an area with a diversity of tools, and the seventh was found 7 m to the east. The presence of bifaces, channel flakes, endscrapers, sidescrapers, gravers, utilized flakes, and more than 1,200 pieces of debitage (table 7.7) indicates a large variety of activities dominated by the finishing of fluted points and various domestic tasks involving scraping and perforating different materials. The abandonment of seven broken fluted points, combined with eight channel flakes (two were mended to fluted points), suggests that this specialized tool type was transported to the site and finished there, with two evidently discarded after being broken during use.

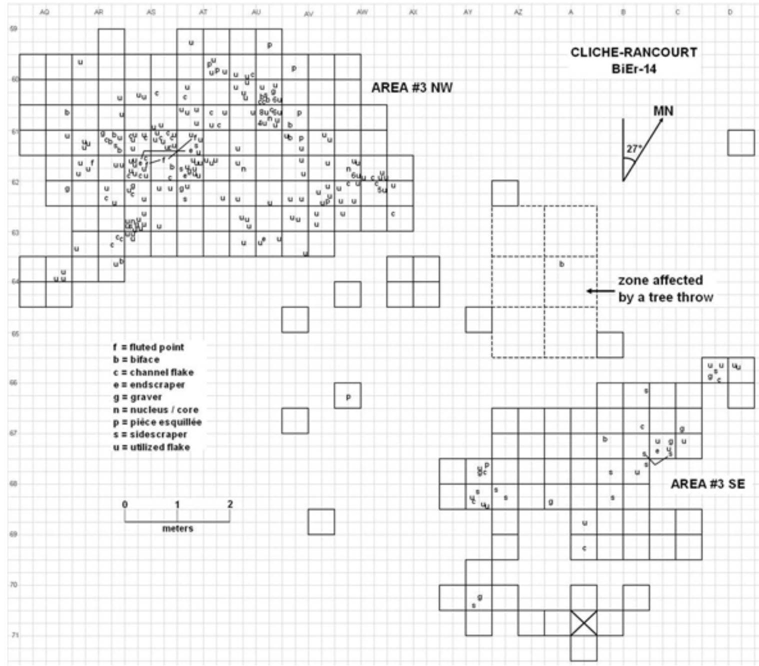
Bifaces used for multiple functions are rare at the Cliche-Rancourt site. The large New Hampshire rhyolite alternately beveled biface, found in seven pieces, was probably broken in situ, and there is a possibility of a ritual kill. This biface is part of the tool concentration, and its dispersal within five distinct contiguous units may have occurred as a result of natural agencies.

Endscrapers and sidescrapers are also few in number. These unifaces, including gravers and utilized flakes, are usually linked to domestic activities involving scraping,

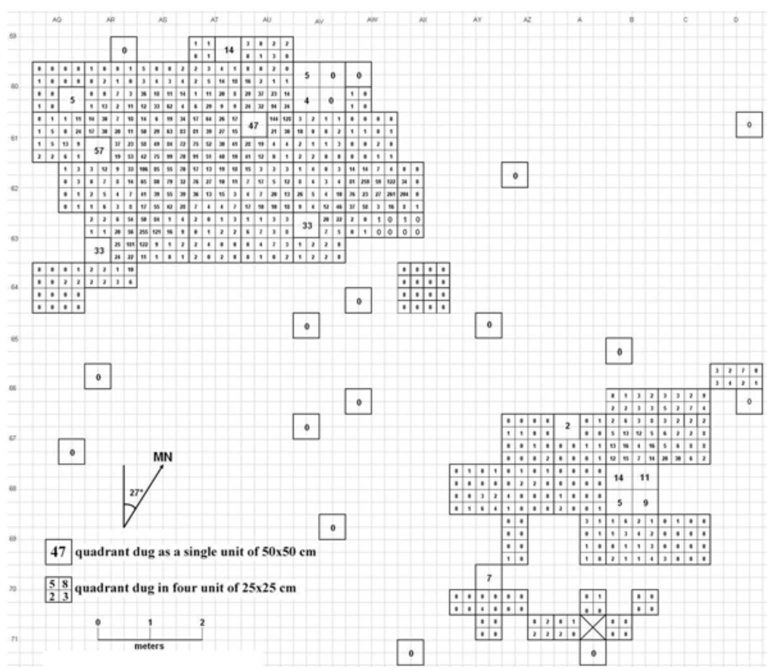
cutting, and perforating various materials. Nonetheless, Area 1 stands out for the importance of hunting gear and the related hunting activities such as the processing of prey.

The small size of Area 2 precludes a detailed comparison with other loci. The limited evidence is, however, sufficient to consider its attribution to the Early Paleoindian period. The identification of two channel flakes, one distal end of a biface, and one sidescraper, all made of red Munsungun chert, as well as the vertical distribution of some of these elements at a depth 40 cm, suggests a brief occupation by hunters using fluted points. The limited number of flakes also argues for a short stop. The distance between Area 1 and 2 is about 12 m, which is large enough to propose that Area 2 was occupied at a different time and for a different, even more specialized purpose. Area 2 could also be coeval with Area 1, but the activities were far more limited and should be considered distinct in nature from Area 1, with its much greater tool diversity.

Area 3NW is similar in size to Area 1. Its content is, however, different, although showing the same tool diversity (table 7.7). One distinction between the two is the higher number of flakes. A second difference is the small number of bifacial tools combined with a large number of utilized flakes. Wedges made of quartz are also distinctive. Fluted points are rare, with a single New Hampshire rhyolite distal end and a red Munsungun chert nonfluted distal end. The identification of a minimum of 26 channel flakes constitutes an indication that the final step in fluted point production was also carried out in Area 3NW. A major activity may have been the finishing and curation of bifaces and fluted points, a conclusion that is awaiting the detailed study of 7,184 flakes to confirm the importance of bifacial thinning flakes. Domestic activities were carried out, but mostly by the use of utilized flakes (figure 7.14). This dominant artifact category is convincingly associated with high densities of flakes in three distinct zones (figure 7.15). Endscrapers are as uncommon as they were in Area 1, and sidescrapers and gravers are present in comparable numbers. The horizontal distribution is thus comparable to Area 1, with a larger spatial extension. Area 3NW is thus considered a workshop area with intensive knapping, but its occupants were using the same tool types encountered in Area 1. Both areas are comparable regarding the selection of raw materials, red Munsungun chert being preferred by a wide margin.



7.14. Tool distribution in Cliche-Rancourt Area 3.



7.15. Debitage distribution in Cliche-Rancourt Area 3.

The smaller Area 3SE is separated from Area 3NW by a 4 m wide corridor with a clear absence of cultural remains (figure 7.14). The horizontal distance is accentuated by other behavioral differences (table 7.7). First, the number of flakes is low in Area 3SE compared to Area 3NW. Bifacial tools are also rare: no fluted points, and a single

biface preform that is not diagnostic. A single endscraper was recovered, but a significant number of sidescrapers and gravers constitute another distinct characteristic of this area. Three channel flakes have been identified as well as a small number of utilized flakes ($n = 13$). The striking feature of Area 3SE is the relative abundance of sidescrapers and gravers. Domestic activities could have been the hallmark of the people inhabiting this area. Of interest is the relative importance of New Hampshire rhyolite in Area 3SE, although several sidescrapers are made of a badly weathered material that we have tentatively classified as rhyolite but could be chert. Chemical analysis could eventually resolve this ambiguity. Nevertheless, the number of tools and flakes identified as New Hampshire rhyolite will have to be considered in the discussion to come on the chronological position of this small sector. Also worth mentioning is the ratio of debitage flakes to tools for Area 3SE, which is distinct from Area 3NW and comparable to Area 1. Even when we calculate a second ratio by using only points, bifaces, endscrapers, sidescrapers, and gravers for the tool count, the distinctiveness remains. Area 3NW is strikingly different because of the large number of utilized flakes and the scarcity of bifacial and formal tools in the context of thousands of flakes.

The internal spatial organization is for now limited to four loci. A fifth one was located in the southwestern portion of the site. Preliminary testing in 2009 suggests that its size should be around 15 m^2 or less. Intensive knapping is identified with more than 2,300 flakes found in only four excavated units. The four loci actually under study present various and distinctive images of human behavior. They do not duplicate the impression we have of the Vail site, where the contents of most loci are similar to one another (Gramly 1982). The recognition of lithic concentrations is the basic approach to identify a locus. Unfortunately, no features were found within each locus. The number of flakes indicates the intensity or longevity of the occupation. We subscribe to the scenario that most loci represent single events, since no superpositioning was recorded (Robinson et al. 2009). The eastern concentration of Area 1 and the small Area 2 could be short occupations at various times during the use of the Cliche-Rancourt physical setting. Areas 1 and 3NW share a diversity of tools, whereas Area 3SE must be considered too different to be coeval. Area 5, 40 m south of Area 1, is intriguing and supports the strong possibility that the Cliche-Rancourt site was visited on several occasions.

To summarize, each locus at the Cliche-Rancourt site may correspond to a distinct set of functions. The complementarity of these loci is rather difficult to support within a scenario that all areas were used simultaneously. Each locus could be characterized by at least one dominant activity: replacing hunting gear in Area 1, retooling within a very short occupation in Area 2, intensive knapping in Area 3NW, and use of Area 3SE for various domestic activities.

No organic material was found that could be used to provide radiometric information. Optical luminescence was used in Area 1 on mineral sediments sampled at 25 cm below the actual surface within the orange sand, or B horizon. The results on feldspars are positive, with two dates averaging 12,125 ± 850 (Lamothe 2007:125–126). More dates are needed to support these first results, and a second series of sediments at a depth around 55 cm was selected in Area 3NW. The analysis is not yet complete, and the results are pending.

IMPLICATIONS OF THE CLICHE-RANCOURT SITE

The addition of Cliche-Rancourt to the group of fluted point sites located in the Far Northeast pushes north of the New Hampshire/Maine border mountains the territory known to be established or exploited by Paleoindians. It means hunters of that era were able to cross these mountains to look for new challenges. Their interest was probably to follow or search for caribou herds that may have been grazing tundra lichens around proto Mégantic Lake. New unpublished field research by Pierre Richard and associates clearly indicates a tundra landscape in the vicinity of Cliche-Rancourt during its entire presumed length of occupation, 12,500–12,200 cal BP, which relative date must be detailed now.

Cultural Relations and Chronology

The number of Paleoindian sites identified in the Far Northeast has increased substantially over the past two decades, but most are plagued by an absence of hearths and charcoal samples found in good archaeological context

(Bonnichsen and Will 1999; Ellis 2002). Besides the promising date of 12,125 ± 850 cal BP obtained by optical luminescence on feldspars, the chronology at the Cliche-Rancourt site must rely, as with most sites, on fluted point typology. Over the past decade a strong influential current has favored a regional taxonomy for eastern North America. It is now convenient to distinguish the Great Lakes areas from the New England–Maritime Peninsula region. A sequence from early to late was recently submitted to the archaeological community (Bradley et al. 2008), but it presents a major problem by attempting to fix the chronology without sufficient radiocarbon dates. Nonetheless, a strong consensus has been achieved by dividing the fluted point era in three phases: Early, Middle, and Late Paleoindian. This new sequence brings new problems that the small sample of fluted point fragments from the Cliche-Rancourt site cannot solve. The seriation order Kings Road/Whipple, Vail/Debert, Bull Brook/West Athens Hill, Michaud/Neponset, Crowfield-related, Cormier/Nicholas for the Early and Middle Paleoindian phases differs from a simpler version proposed here in table 7.8; differences are in the Early Paleoindian phase, and the only discordance for the Middle phase is the absence of Crowfield. Otherwise, the sample from Cliche-Rancourt fits pretty well into the Michaud/Neponset variety of the Middle Paleoindian.

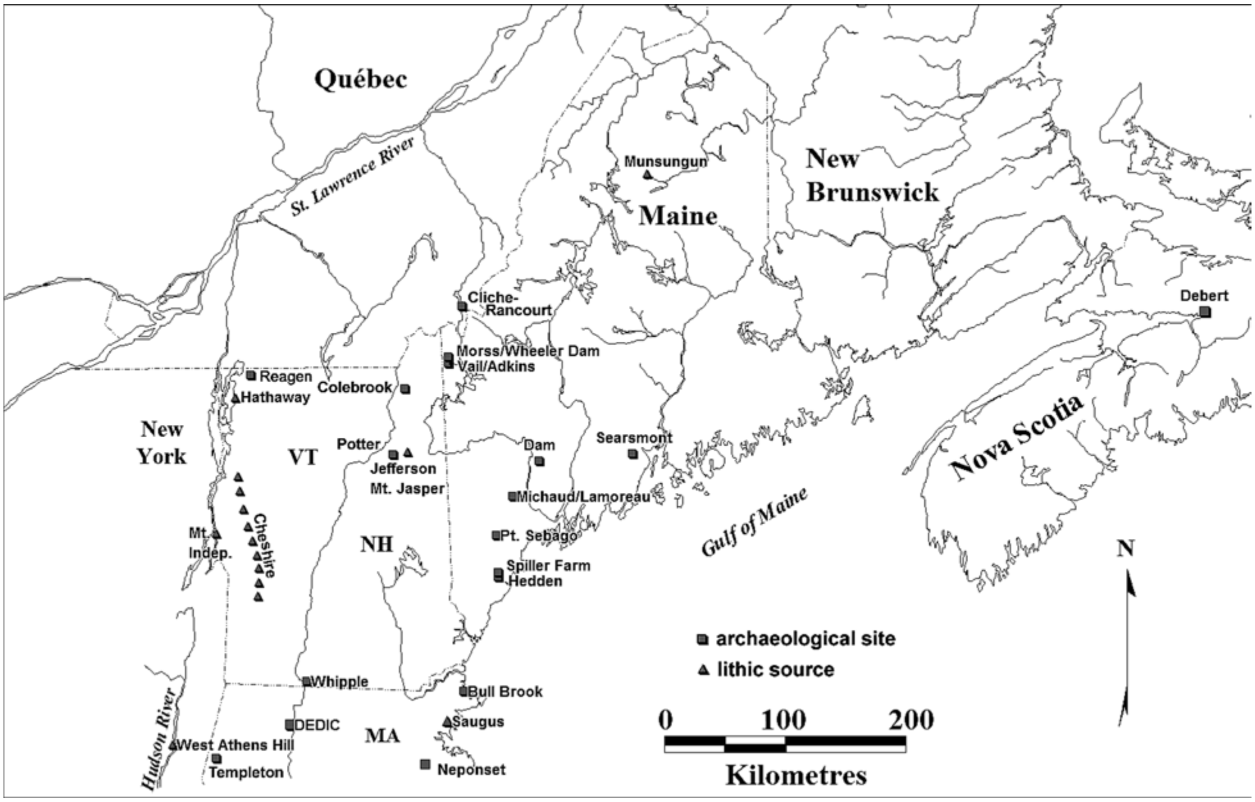
Three observations help the assignment of fluted point fragments from Cliche-Rancourt to the Michaud/Neponset type: the presence of a slight inflexion producing basal ears on the two finished bases; the length of the fluted scars exceeding 50 percent of the estimated point lengths and probably reaching 75 percent; and the basal concavity depth of 6 mm and 4.5 mm for the two finished bases, which is consistent with several Michaud/Neponset examples. The eight fluted point fragments lead to a single model favoring a lanceolate shape over a waisted base and a shallow basal concavity depth from which the thinning was obtained by taking long channel flakes covering around 75 percent of the specimens' length. The metric data also fit well with the range known for the Michaud/Neponset sample. In addition, grinding of the base and sides is present on the two finished bases at Cliche-Rancourt, as is a tendency for fluted scars to extend the length of the tool on one side, as shown by the red Munsungun chert distal end (CR-467; see figure 7.4). It is thus appropriate to consider our small group of fluted point fragments as a northern variant of the Michaud/Neponset type and to date them to the Middle Paleoindian phase (Bradley et al. 2008). We consider this attribution only tentative because of the limited size of our sample, the absence of at least one complete specimen, and the high diversity of fluted point morphology and size as a tool class category (see Ellis 2004).

Assuming a relative date range of 12,500–12,200 cal BP, and that early settlement of the area was possible as much as one or two centuries earlier, the Cliche-Rancourt site may not be the earliest human incursion into the area, and additional sites could eventually be found within the region

Table 7.8. Relative Chronologies of Paleoindian Point Styles

*Date cal BP**	*Quebec*	*New England*	*Great Lakes*	*Features*
		EARLY PALEOINDIAN		
12,900–12,500		Bull Brook Vail/Debert	Gainey/Butler	short flute
12,500–11,900	Trois-Lacs complex: Michaud/Neponset	Michaud/Neponset	Parkhill complex: Barnes/Crowfield	long flute
11,900–11,400	Cormier/Nicholas?	Cormier/Nicholas	Holcombe	short flute if present
		LATE PALEOINDIAN		
11,400–10,800	Agate Basin (Plano)	Agate Basin (Plano)	Agate Basin (Plano)	parallel flaking on lanceolate shape
10,800–9500	Ste. Anne/Varney (Eden, Plano)	Ste. Anne/Varney (Eden, Plano)	Eden (Plano)	fine parallel flaking on narrow lanceolate shape

*Dates are calibrated in solar years; see Bradley et al. (2008) for different time intervals.



7.16. Cliche-Rancourt lithic network and the locations of major related sites.

that enable us to reconstruct the settlement history of the area. With the optimistic perspective of a true regional group comprising the Cliche-Rancourt site occupations, we propose a Trois-Lacs complex (in reference to Mégantic, Joncs, and Araignées lakes), although relying for the moment on a single component, which is probably premature but should stimulate the search for more sites in the near future. The geographic position of the Cliche-Rancourt site is a strategic one north of the Boundary Mountains, and the site is certainly not the only site of this new Paleoindian territory. Additional fluted points, especially complete specimens, should strengthen the association between the Cliche-Rancourt site and the Michaud/Neponset phase.

A study of cultural relations between the occupants of the Cliche-Rancourt sites and other sites should first consider coeval Michaud/Neponset sites (figure 7.16). Few sites of that phase have been thoroughly excavated and published (Bradley et al. 2008:144–145); the Templeton and Michaud sites are exceptions (Moeller 1980; Spiess and Wilson 1987). Ongoing research in northern New Hampshire at the Potter and Colebrook sites (Boisvert, this volume), in Maine at several sites (Spiess and Newby 2002; Spiess et al., this volume), and in Massachusetts at the Neponset site (Carty and Spiess 1992; Donta 2005) is producing clear evidence of this Michaud/Neponset style. Besides fluted point comparisons, other links can be made. First, the scarcity or absence of fluted drills, limaces, and wedges (pièces esquillées) is notable and seems to confirm the chronological sensitivity of these tool types to distinguish phases or groups of sites (Ellis and Deller 1997). Second, the similarity of spurred endscrapers, sidescrapers made on large flakes, gravers, and large alternately beveled bifaces is convincing (Boisvert 1998, 1999, 2004, 2008; Boisvert and Puseman 2001; Spiess and Hedden 2000; Spiess et al. 1998). Even errors in the fluting process, the outrepassé fracture, are present at sites such as Michaud, Lamoreau (Spiess and Wilson 1987:42–43, 126–127), and Cliche-Rancourt (see figure 7.6). Third, the selection of a limited array of lithic sources to make their tools seems to unite most groups assigned to the Michaud/Neponset phase. It is indeed surprising, considering the size of the territory involved, that most groups favored the red Munsungun chert, with the exception of north-

ern New Hampshire sites, where the local rhyolites were used abundantly but never without a fair amount of tools made of red Munsungun chert. This propensity for using the same lithic sources points to an adaptive strategy shared by several groups forming a large band in the ethnographic sense. It could thus be proposed that the generalized use of red Munsungun chert is a trademark of related groups during the Michaud/Neponset phase and that their cultural relations were probably largely based on kinship. It should not be forgotten that the hunters and their families who camped at the Cliche-Rancourt site had easy access to the Kennebec River drainage. Therefore, close relations with groups who occupied Michaud, Lamoreau, and other sites of the lower Kennebec Valley should be expected.

Adaptation: Seasonal Movements and Lithic Acquisition

The capacity of Early Paleoindian hunters to move around and cover large tracts within a single year is still a dominant model (Ellis and Lothrop 1989). Explanation of lithic procurement patterns is thus seen here within this nomadic perspective, which favors direct acquisition without eliminating trade as a way to get some chipping stone, probably in a semifinished state (see Lothrop and Bradley, this volume).

Taking into account the strong possibility that hunters exploited resources of a tundra environment when crossing the mountain pass leading to proto Mégantic Lake, we can investigate when the best time was to do it and what we can learn from the reconstruction of the lithic network. It is obvious that they were traveling with enough tools in their leather bags, since the sources were located far away. If they were revisiting the Cliche-Rancourt site, on their previous visit they may have left behind some tools that could be used in case of shortage. They were coming into this new northern country to exploit the fauna. There is no indication that very good silicate was available to them in the region (Burke 2007). Regarding the caribou exploitation, using modern analogues, the best time to hunt is definitely fall. Depending on the environmental conditions, early fall could be more appropriate than late fall. Exploitation of other natural resources is conceivable in the vicinity of Cliche-Rancourt during summer within the perspective that specialized hunting was seasonal and subsistence patterns were more generalized. With its northern location, the Cliche-Rancourt site was certainly occupied from late summer through fall. The incentive for this human presence is probably the possibility of intercepting caribou herds before returning south for the winter through the mountain passes, which could have been the routes used by caribou as well. The human movement northward could thus be linked to a similar northward expansion of migrating caribou looking for tundra. This barren-ground caribou scenario is not totally shared by other scholars if the available caribou at that time period were the woodland variety, which in a modern situation do not live in large numbers and do not migrate over long distances (Dincauze 1993). This question has not been debated because of the few bone remains for this species recovered on sites and also because it is quite difficult to distinguish the two types of caribou on the basis of bone morphology.

If caribou were a good reason to extend the hunting territory to include a new northern territory, the need for tool stone must have been taken care of elsewhere. The annual cycle might be determined by identifying lithic sources. Visual identification of a lithic material is the most commonly used method in archaeology, although most practitioners know that a good margin of error is included. Optical and chemical approaches are used more regularly to define sources or specimens that are representative of the assemblage under study. Our identifications of red Munsungun chert (Pollock et al. 1999) and a variety of New Hampshire rhyolites (Pollock et al. 2008a, 2008b) are based on a large number of specimens and general agreement from other scholars who confirmed the proposed identifications.

Is it possible that the Cliche-Rancourt group went directly to both lithic sources as part of their standard procurement strategy? Munsungun sources are located, in a straight line, 180 km from our site. Using geographic features to travel from one area to the other, a journey of more than 300 km is likely. The Mount Jasper source is located 120 km in a straight line from our site, and a trip there could have been very long if a portage was not made to cross westward instead of going down to the junction of the Androscoggin and Kennebec rivers near the Atlantic coast. Otherwise, the trip could be estimated at a minimum of 200 km, making the whole cycle more than 500 km to acquire the two main lithic materials directly. Red Munsungun chert was the dominant source at Cliche-Rancourt,

and the acquisition of New Hampshire rhyolites was probably indirect through trade.

Red Munsungun chert had the upper hand in economic relations between interacting groups, with a more impressive geographic distribution. It is fair to say that the high quality of this silicate is the obvious reason for its extensive use, but it must be added that New Hampshire rhyolites, although considered average in quality, were definitely part of the distribution pattern and were also embedded in social as well as economic relations between groups. The use of New Hampshire rhyolites at remote sites such as Cliche-Rancourt is a good indication of how important the circulation of this resource was for these groups, and that it may have been at some point an identity marker. The lithic network encompassing the Cliche-Rancourt site consists of a node in a bigger picture: the northeastern end is Munsungun, the western end is Mount Jasper/Jefferson, the southern end is the Michaud cluster, and the northern end is the Cliche-Rancourt site. This territory is huge, and seasonal movements of hunter-gatherer groups within it would be expected (Burke 2006; Burke and Chapdelaine 2009). The logical choice of a lithic source for the Cliche-Rancourt group should have been the New Hampshire rhyolite, since it is nearer. A cultural choice was thus made as well as a preference for the better quality of the red Munsungun chert. This choice is even more surprising at sites located more than 300 km away from Munsungun, which have a 60 percent presence of this red stone in their assemblages (Burke 2006).

Regarding the lithic network of the Cliche-Rancourt group, it seems obvious that the less abundant New Hampshire rhyolites were obtained as finished tools, because few flakes are found and most tools are broken and discarded as fragments. To reach the Munsungun sources an eastern movement was necessary, especially if the hypothesis of direct access to the source is advanced; to obtain New Hampshire rhyolites a western movement was necessary, making the lithic acquisition pattern an east-west axis, which is confirmed by other sites (Spiess and Hedden 2000). The number of Munsungun tools and debitage flakes at the Cliche-Rancourt site is a good indication that this source was visited regularly within the seasonal cycle of the group. Since the Munsungun area is upland and certainly not an ideal place to spend winter during the Younger Dryas, the different groups who were exploiting this lithic source and the caribou in a landscape dominated by a tundra (Bonnichsen et al. 1985; Dincauze 1988; Pelletier and Robinson 2005) had then reached the northeastern tip of their nomadic cycle. They probably identified with the Kennebec River, and the southern portion of the basin was the center of their summer and fall occupation. It was during some western trips that this Kennebec group made contact with the western bands exploiting the Androscoggin River basin. They probably exchanged lithic tools and other goods, mostly perishables, and the fair number of red Munsungun tools on northwestern New Hampshire sites supports this exchange scenario (see Boisvert, this volume).

CONCLUSIONS

The Cliche-Rancourt site opens a new window into the past, allowing the writing of the oldest possible chapter in Quebec prehistory (Chapdelaine 2011). For the moment, it is the only site that has produced fluted points in the entire province of Quebec. Being the northernmost site of this Early Paleoindian era for the Far Northeast, its location within a tundra environment supports the model of early hunters following barren-ground caribou herds. Changing conditions in southern latitudes with the advance of a mixed forest and the tradition of going north at the end of the summer to intercept migrating caribou suggest a plausible explanation for this human movement north of a mountain range that could be crossed via a few easy mountain passes. The largest and easiest of these led directly to a large body of water, proto Mégantic Lake, which could have attracted hunters with its rich fauna.

A second corridor, the Hudson–Lake Champlain axis, may also have been exploited to move northward (Chapdelaine 1985; Loring 1980). The Reagen site, located near the Quebec border (Robinson 2008, 2009; Robinson and Crock 2008; and see F. Robinson, this volume) occupied a high terrace above the Champlain Sea. However, not a single Quebec site has been discovered along the Richelieu River or on fossil beaches or terraces related to the Champlain Sea to give evidence of this entry route.

The internal spatial organization of the Cliche-Rancourt site is typical of most Early Paleoindian sites, with distinct loci scattered across the landscape with little or no overlap.

The originality of this site is the distinct function of each locus, where toolkit and reduction sequence differ greatly. This patterning, combined with tool diversity, seems to argue for several visits to the site. If this assumption is correct, it is logical that the group stopped at other places in the region and that the Cliche-Rancourt site is probably not the only site of this era in the region. It is also plausible that this site is not the oldest if water levels were already similar to the present-day ones and well-drained terraces were open to early settlers around 12,600 cal BP. Based on a fluted point typology similar to the Michaud/Neponset point style, the small group of eight fluted point fragments can be assigned with confidence to the Early Paleoindian middle phase. This middle phase is not well dated, for there are few radiocarbon dates. However, using the same construct of point types viewed as a time series developed for southern Ontario (Ellis and Deller 1997), the estimated time range for the Cliche-Rancourt occupation is between 12,500 and 12,200 cal BP, or 10,500–10,300 ^{14}C yr BP.

A long occupational sequence is now established for the Mégantic Lake area, and new data from the Quebec City area are exciting (Pintal 2002; and see Pintal, this volume). We now have a new corridor open for investigation, the Chaudière River valley. Our fieldwork is not completed at the Cliche-Rancourt site. More analysis is needed, especially of the lithic flakes, and the new Area 5 should stir our energy in the coming years.

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CHAPTER VIII

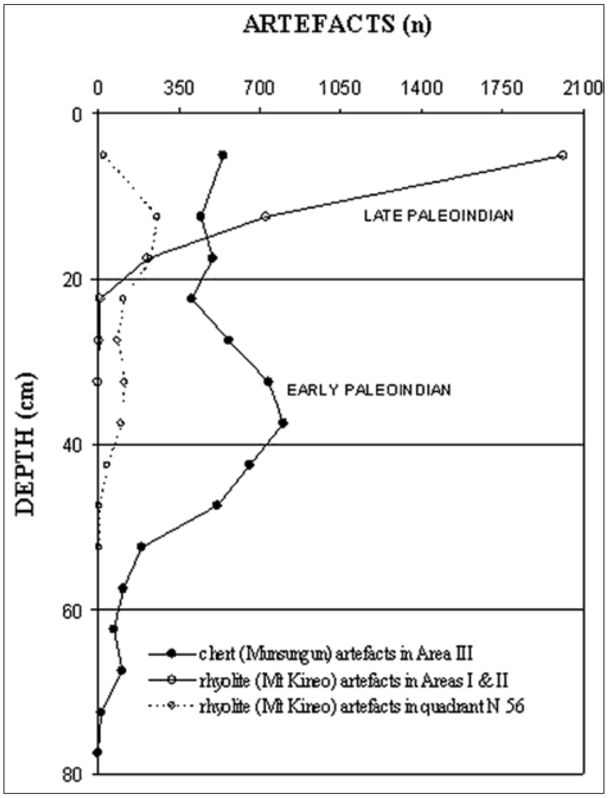
The Burial of Early Paleoindian Artifacts in the Podzols of the Cliche-Rancourt Site, Quebec

François Courchesne, Jacynthe Masse, and Marc Girard

The discovery of the first fluted points of the Early Paleoindian period at the Cliche-Rancourt site near Mégantic Lake in 2003 was a landmark for archaeological studies in Quebec. This discovery initiated a large research program to reconstruct the first human occupations on the territory of Quebec as deglaciation progressed.

At the Cliche-Rancourt site, archaeologists identified two Paleoindian occupations, each with a distinct chronology. The first, the Early Paleoindian, is associated to fluted points and covered the period 12,500–12,200 cal BP; the Late Paleoindian, identified through Agate Basin–related points, lasted from 11,500 to 10,750 cal BP (Chapdelaine 2007). The earliest occupants were believed to be hunters following caribou herds transiting through the Mégantic area, the Méganticois. This hypothesis is supported by the results of recent paleoenvironmental research conducted in the area of the Cliche-Rancourt site (Richard 2007). This research showed that Wisconsinian ice had definitively left the Mégantic area by 13,100 cal BP. Around 12,500 to about 12,200 years ago, ice subsisted in Gaspésie, Nova Scotia, and in parts of Prince Edward Island (Richard 2007). In short, the climatic conditions during the first occupation period of the Cliche-Rancourt site were still cold, and the prevailing tundra and taiga vegetation constituted an attractive environment for migrating caribou herds (Chapdelaine 2004). Moreover, the Cliche-Rancourt site location at the junction of two major water bodies offered a strategic position to potential occupants. A thousand years later, during the Late Paleoindian, environmental conditions were still favorable for the migration of caribou despite the fact that the climate had warmed up and that an open fir forest dominated the area. Forest cover is thought to have appeared about 11,900 cal BP, and its canopy is considered to have gradually closed up 9000–7200 cal BP (Richard 2007). Based on these paleoenvironmental reconstitutions, about 3,000 years separated the first human occupation of the territory, the Early Paleoindian period, from the development of the maple-beech forest that now covers the landscape of the Mégantic Lake area.

A peculiar observation made at the Cliche-Rancourt site is the presence of cultural remains at a depth of more than 70 cm in soil profiles, though the regional average for the burial of artifacts is close to 25 cm (Chapdelaine 2007). It should also be noted that the artifacts from the two occupation periods have a distinctive depth distribution (figure 8.1). The artifacts of the Late Paleoindian period (made of Mount Kineo rhyolite) are concentrated (88 percent of



8.1. Profile distributions of artifacts from the two Paleoindian occupation periods at the Cliche-Rancourt site. The line with filled circles represents chert artifacts from the Early Paleoindian; the line with open circles represents rhyolite artifacts from the Late Paleoindian. The dashed line represents the Late Paleoindian artifacts from quadrant N56, the only ones found at depths of more than 30 cm.

the total) in the first 15 cm of the profile and are thus mostly present in the organic surface or in the eluvial (Ae) mineral horizons. Only a few artifacts from that period are found as deep as 25–45 cm in mineral B horizon, and they were, in all cases, found in a single quadrant (N56) in association with buried portions of the Ae horizon (dashed line in figure 8.1). The artifacts of the Early Paleoindian period (made of Munsungun chert) are more widely distributed in the soil profiles, and some of them are even found down to 75 cm, an unusual depth for artifacts in soils of the Far Northeast.

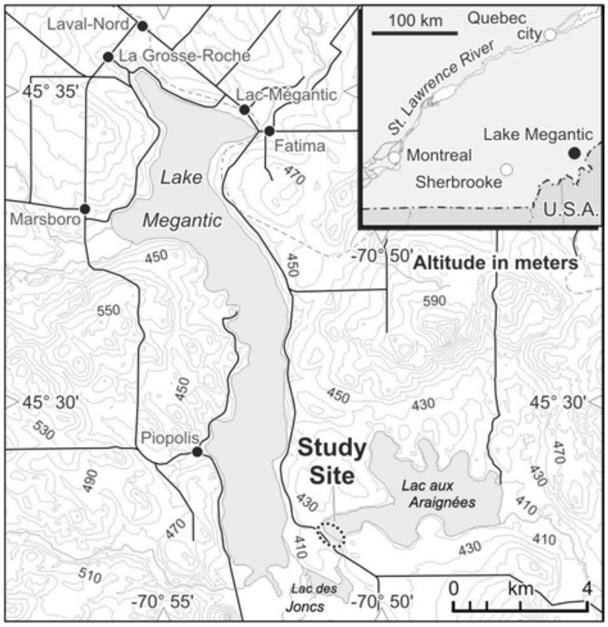
These observations obviously raise the issue of pedogenetic processes that have the potential to transfer human artifacts from the soil surface to the base of the solum and to the subsolum. Several working hypotheses were previously formulated to explain the burial of artifacts, including the existence of successive sedimentation stages and the impact of the trampling of the soil surface by the occupants (Chapdelaine 2007). Stratigraphic analysis of the soil substrate at Cliche-Rancourt, however, shows that the artifacts from the Early Paleoindian period are found in the two stratigraphic units, or soil parent materials, present at the site, a sandy proglacial outwash sediment containing several large blocks covering a dense silty sediment. The artifacts from the Late Paleoindian period are all found in the more surficial sandy proglacial unit. It follows that the hypothesis of successive sedimentary episodes cannot explain the deep burial of artifacts from the Early Paleoindian or from the Late Paleoindian at quadrant N56.

The effects of soil trampling or surface compaction cannot be ruled out at Cliche-Rancourt, but the impact of this process is essentially superficial and thus does not explain the presence of numerous artifacts at depths of more than 20 cm (Andrews 2006). The deep burial of artifacts has also been reported in several other archaeological studies of the Far Northeast, in particular at the Neal Garrison (Kellogg 2003) and Hedden (Spiess et al. 1995) sites in Maine. In all cases, our understanding of the intricate roles of past and present pedogenetic processes, in particular the contribution of physical disturbances such as floralturbation, faunalturbation, and cryoturbation, is still fragmentary, and these process needed to be explored further before we can explain the deep burial of artifacts in soils during the late Pleistocene and early Holocene.

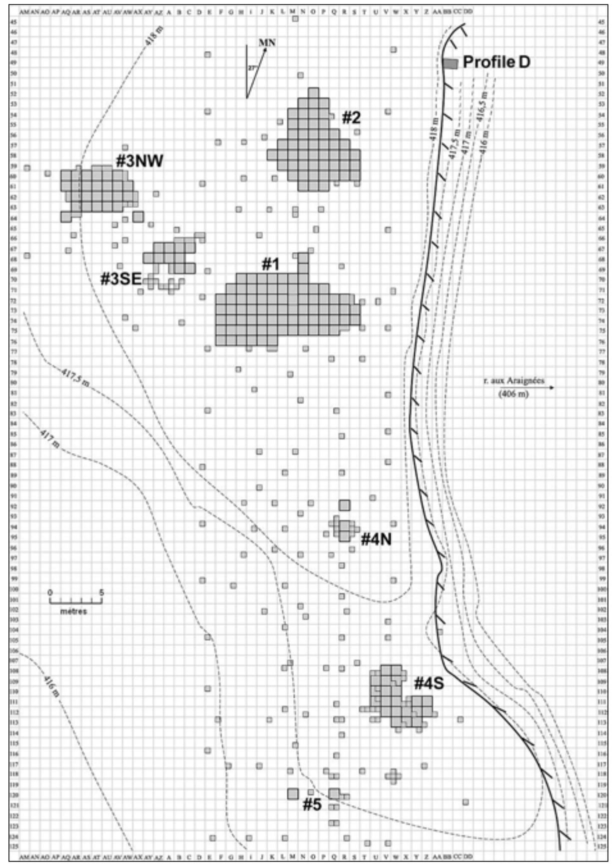
In this context, the main objective of our study was to identify the soil processes that contributed to the deep burial of artifacts in the soils of the Cliche-Rancourt site. Our approach combined fieldwork, laboratory analyses, and three-dimensional imaging in order to quantify the chemical, physical, and mineralogical properties of soils that will allow us to identify the past pedogenetic processes and those that are presently active at Cliche-Rancourt.

STUDY SITE

The Cliche-Rancourt site is located on a narrow terrace separating Araignées Lake and Mégantic Lake (figure 8.2). The area has a mean annual air temperature of 3.9°C (18.2°C in July; -11°C in January) and receives a mean total of 1,052 mm of precipitation per year, of which 779 mm falls as rain (Canada, n.d.). The site is at an altitude of



8.2. Mégantic Lake area and location of the Cliche-Rancourt site (National topographic database, Canada. Government of Canada NAD83. Landsat 7 ortho-images of Canada. Government of Canada).



8.3. Plan view of the five Cliche-Rancourt site excavation areas and location of soil profile D.

418 m above sea level and dominates the Araignées River by 12 m, from which it is separated by an abrupt slope. The terrace was never flooded after the Champlain marine transgression of about 13,100 cal BP. Therefore, the burial of Paleoindian artifacts must be the result of either human activity or soil processes. The area that yielded the artifacts is covered by a late Pleistocene sandy proglacial outwash sediment with abundant boulders and pebbles topping a dense silty sediment with isolated blocks (Shilts 1981). The natural drainage is good to very good, and the site thus appears an ideal location for Paleoindians (Chapdelaine 2004). The vegetation evolved from an American dwarf birch (*Betula glandulosa*) tundra to a sugar maple (*Acer saccharum*) forest with mature yellow birch (*Betula alleghaniensis*) (P. Richard, personal communication) under which podzolic-type acidic forest soils developed to a depth of about 50–75 cm.

At the Cliche-Rancourt site, excavation intensified in 2003 after the discovery of the first fluted points in Quebec. A plan view of the excavation areas is presented in figure 8.3. Areas 1 and 2 were mostly excavated between 2003 and 2005, Area 3 was studied from 2006 to 2009, and Areas 4 and 5 were studied in 2009 (Chapdelaine 2009). The artifacts linked to the earliest occupation period (12,500–12,200 cal BP) are concentrated in the western half of Area 1, in a small portion of Area 2, and in Area 3, and the artifacts from the second occupation (11,500–10,750 cal BP) are mostly found in the eastern part of Area 1 and in Area 2.

MATERIALS AND METHODS

The soil samples were collected in July 2007. A total of four soil profiles were dug, and each horizon was described. One of the profiles (profile D) is located at the northeastern margin of the site (see figure 8.3), and the other three profiles (A, B, and C) are situated in Area 3 at coordinate AT60 (figure 8.4). The chemical, physical, and mineralogical properties of individual soil horizons were determined for profiles A, B, and D. To that end, soil pH, organic carbon content, cation exchange capacity (CEC), bulk density, and grain size distribution were measured to identify the major pedogenetic processes. Extractable Al and Fe content and

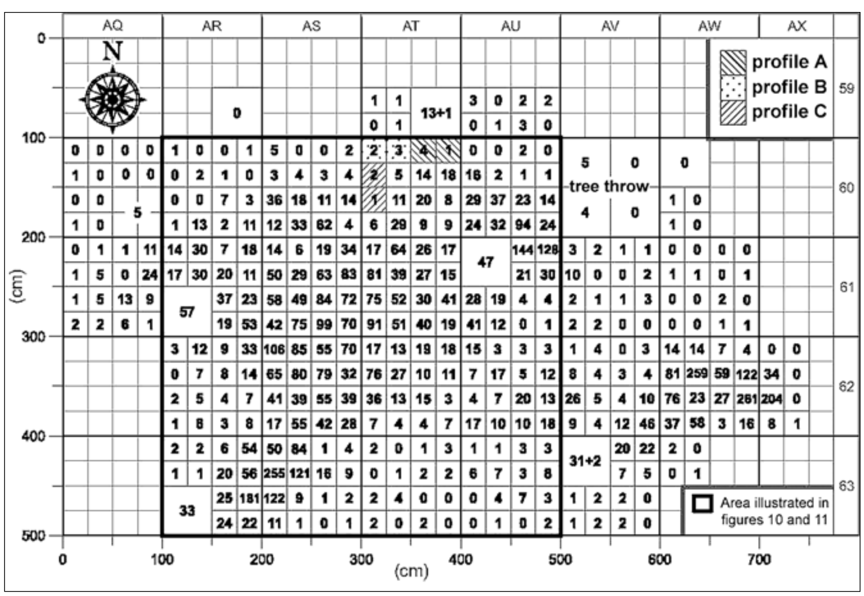
mineralogy are useful for detecting active and past pedogenetic processes, in particular in podzolic soils (Carter and Gregorich 2007). The designation of soil horizon and the classification of profiles are based on the Canadian system of soil classification (Groupe de travail sur la classification des sols 2002). By convention the 0 cm depth in soil profiles is located at the interface between the organic and the mineral horizons, not at the soil surface. In this chapter, all references to depth values are calculated from the soil surface.

The soil pH in water (pH_{H2O}) was measured at a 1:2 soil:solution ratio, and the concentration of organic carbon was obtained after oxidation with H_2SO_4. The cation exchange capacity was determined as the sum of the cations Ca, Mg, K, Na, Al, Fe, and Mn that could be exchanged by $BaCl_2$ (Hendershot and Duquette 1986). The sodium pyrophosphate, acid ammonium oxalate, and dithionite citrate extractions were performed for Al and Fe according to Courchesne and Turmel (2007). Sodium pyrophosphate is thought to extract organometallic Al and Fe complexes, and amorphous inorganic and crystalline metallic forms were estimated by the oxalate and dithionite citrate extracts, respectively. The abundance of these Al and Fe compounds reflects the intensity and pathways of pedogenesis.

The bulk density of inorganic soil horizons thicker than 5 cm was evaluated by gravimetry after oven-drying triplicate 150 cm^3 soil samples at 400°C in a metal container for three days (Culley 1993). The particle-size analysis of the mineral horizons of profile A was established by sedimentation in the presence of 5 g/L of sodium metaphosphate following the destruction of coatings and organics with dithionite citrate (Gee and Bauder 1986) and by dry-sieving to separate the sand fractions.

The mineralogical composition of the clay (<2 μm) and fine silt (2–20 μm) fractions of the mineral horizons of profile A was determined by X-ray diffraction according to Whittig and Allardice (1986) and Amonette and Zelazny (1994). Pretreatments were performed using sodium hypochlorite at a pH of 9.5 to destroy organic matter and with dithionite citrate to eliminate Fe and Al sesquioxides. The clays and silts were saturated with magnesium, magnesium-ethylene glycol, or potassium at 25°C. The samples were mounted on individual glass slides with a preferential orientation following sedimentation. After a first X-ray diffraction analysis at 250°C (K-25), the K-saturated slides were heated at 3000°C (K-300) and 5500°C (K-550) and reanalyzed using a Rigaku Miniflex diffractometer at a scanning speed of 200 per minute from 2° to 300°. To normalize diffractograms, an intensity ratio (I_x/I_{QZ}) was calculated for each mineral using the height of its peak (I_x) divided by the height of the quartz peak (I_{QZ}) at d = 0.426 nm (Courchesne and Gobran 1997).

The plan views, the cross-sectional views, and the three-dimensional images of the spatial distribution of artifacts in



8.4. Plan view of Area 3 and location of soil profiles A, B, and C. The total number of artifacts found over the full depth of a given quadrant (25 cm by 25 cm soil surface) is indicated.

the soils of the Cliche-Rancourt site were produced using Origin 8 (OriginLab Corporation 2008). The total excavated soil volume represented in these images, a large portion of excavation Area 3, is 400 cm by 400 cm (total ground surface of 16 m^2) and has a depth of 80 cm (figure 8.3). It contains sixteen distinct and adjacent square-meter units, the contiguous excavation quadrants AR60 to AU63, with each unit divided in sixteen discrete 25 cm by 25 cm subunits (figure 8.4). The total soil volume imaged was first subdivided into individual 25 cm by 25 cm by 5 cm deep excavated units. Each of these units was defined by its spatial coordinates (*x, y, z*) measured in the field and positioned in three-dimensional space. The number of artifacts found in each of these 25 by 25 by 5 cm soil units was then added as a fourth dimension (*n*). The three-dimensional graphic representations are structured and presented using the *z* dimension as the vertical axis and the view from the north as the reference 00 rotation. Finally, the 0–1800, 30–2100, 60–2400, and 105–2850 rotations were selected among all rotations and presented in figures because they allow the best visualization of spatial attributes relative to the distribution of artifacts in the soil volume.

RESULTS

Soil Properties

The soils of the Cliche-Rancourt site contain, from the top to the bottom of the profile, the following sequence: FH organic horizons under a forest litter (L); an eluvial Ae horizon depleted of weatherable minerals; inorganic B horizons accumulating Fe, Al, and organic matter (Bhf and Bf); and a gleyed IICg horizon (tables 8.1 and 8.2). A transitional BC horizon is present, as can be seen in profile B. The solum (developed in the surficial proglacial outwash material) is generally thin, and the top of the IICg horizon (in the lower stratigraphic unit, the dense silty sediment) is about 55–65 cm from the soil surface. All horizons have a loamy sand texture except for the much finer silty IICg horizon. Similarly, bulk density increases sharply (+35 percent) at the transition between the Bf2 and IICg horizons. In the four soil profiles, physically disturbed horizons are clearly visible (the letter "u" is used in the tables to identify horizons disturbed by natural processes, as in Aeu or Bfu), emphasizing the extent of pedoturbation phenomena at Cliche-Rancourt.

The solum of the three profiles is strongly acidic compared to the subsolum IICg horizon, with pH_{H2O} below 4.0 in surface organic horizons (figure 8.5). The profile distribution of organic C shows two maxima, one in the surface FH horizons and a second in the mineral Bhf. The vertical changes in soil CEC are intimately associated with the profile variations in organic carbon content (table 8.2) and, hence, with the abundance of soil organic matter that constitutes the main source of exchange sites. Ca, and to a lesser extent Mg and K, are the dominant exchangeable cations in the organic horizons and in IICg, whereas Al and Fe represent up to 95 percent of the CEC in the Ae and B horizons. In the mineral horizons, extractable Fe and Al are distributed according to a depth pattern that matches that of organic carbon (figure 8.6). For Al, the organic complexes are the most abundant forms. In the case of Fe, the crystalline inorganic forms are dominant except in the Bhf and first Bf horizons, where organically complexed Fe abounds. The mineralogical analysis of the clay fraction of

Table 8.1. Physical Properties of the Horizons of Soil Profile A, Cliche-Rancourt Site

Horizon	*Depth (cm)*	*Density (g/cm^3)*	*Sand, very coarse*	*Sand, coarse*	*Sand, medium*	*Sand, fine*	*Sand, very fine*	*Sand*	*Silt*	*Clay*	*Texture*
					%						
FH	10–0	-						-	-	-	-
Ae	0–17	1.01	2	5	13	20	20	60	36	4	sandy loam
Bhf	17–22	0.99	6	7	12	19	16	60	37	3	sandy loam
Bf_1	22–30	1.18	4	5	10	19	18	56	41	3	sandy loam
Bfu	-	-	3	6	12	17	14	51	47	2	sandy loam
Bf_2	30–39	1.26	4	5	9	16	14	48	47	5	sandy loam
IICg	39–110+	1.71	2	3	6	12	12	35	53	12	silty loam

Table 8.2. Exchangeable Cations and Cation Exchange Capacity (CEC) in the Horizons of Soil Profiles A, B, and D, Cliche-Rancourt Site

Horizon	*Depth* *cm*	*Ca*	*Mg*	*K*	*Na*	*Fe*	*Al*	*Mn*	*CEC*
					cmol(+)/kg				
				Profile A					
FH	10–0	25.80	2.42	1.20	0.06	0.45	1.07	0.22	31.28
Ae	0–17	0.47	0.10	0.06	0.01	0.03	0.86	0.00	1.52
Bhf	17–22	0.56	0.10	0.05	0.02	0.62	6.30	0.00	7.66
Bf1	22–30	0.12	0.05	0.04	0.02	0.18	3.46	0.00	3.88
Bf2	30–39	0.38	0.12	0.13	0.01	0.02	1.07	0.00	1.73
IICg	39–110+	1.78	1.36	0.35	0.01	0.00	0.14	0.07	3.74
				Profile B					
FH	6–0	26.51	1.54	0.85	0.06	0.79	3.15	0.04	32.99
Ae	0–7	0.75	0.12	0.04	0.01	0.04	1.36	0.00	2.32
Bhf	7–11	1.25	0.20	0.14	0.02	0.65	7.10	0.00	9.37
Bf1	11–16	0.11	0.05	0.03	0.02	0.11	3.62	0.00	3.94
Bf2	16–30	0.04	0.02	0.02	0.01	0.03	1.20	0.00	1.33
BC	30–42	0.01	0.08	0.15	0.01	0.02	0.42	0.00	0.71
IICg	42–110+	0.13	0.18	0.18	0.01	0.01	0.20	0.00	0.72
				Profile D					
FH	4–0	1.42	0.79	0.34	0.01	0.24	1.95	0.01	4.81
Aeu	0–6	0.03	0.14	0.03	0.01	0.09	3.37	0.00	3.68
Bhf	6–10	0.09	0.12	0.08	0.01	0.96	7.86	0.00	9.13
Bfu	10–22	0.05	0.03	0.02	0.01	0.16	3.45	0.01	3.73
IIC	22–44	0.04	0.02	0.02	0.01	0.01	0.75	0.00	0.85
Ahb	44–46	0.28	0.12	0.02	0.01	0.01	0.51	0.01	0.97
IIIC	46–72	0.09	0.10	0.02	0.01	0.02	0.21	0.00	0.45
IVC	72–92	0.50	0.41	0.03	0.01	0.01	0.02	0.00	0.98
IIC	92–94	1.32	1.40	0.08	0.01	0.01	0.00	0.01	2.83
IVC	94–104	0.74	0.72	0.04	0.01	0.01	0.00	0.00	1.53
IIC	104–107	1.43	1.90	0.13	0.01	0.01	0.00	0.01	3.49
IVC	107–120	0.67	0.70	0.04	0.01	0.02	0.01	0.00	1.45
IIC	120–122	1.20	1.48	0.12	0.01	0.01	0.00	0.01	2.83
IVC	122–146	0.65	0.67	0.03	0.01	0.01	0.02	0.00	1.40
IIC	146–176	0.95	1.32	0.05	0.01	0.01	0.00	0.00	2.35

profile A reveals the existence of two major groups of minerals. One group includes pyroxenes, chlorite, and micas, a series of minerals affected by weathering, as shown by their decreasing abundance (I_x/I_{QZ}) from the Bf2 to the Ae horizon (table 8.3). The second group are neoformed minerals, the abundance of which increases from the Bf2 to the Ae horizons, as can be seen for vermiculite and interstratified phases. The K-feldspar and plagioclase contents follow no specific trend. Moreover, the mineralogy of the IICg horizons differs from that of the other horizons, confirming, together with textural and bulk density data, the presence of a lithological discontinuity in the soils of the site. Two distinct parent materials thus appear to be superimposed in these soils. The material on top is a sandy outwash deposit containing decimetric rock fragments that rests on a dense silty sediment with few coarse fragments. The latter sediment is richer in micas and plagioclases than the outwash but is chlorite poor. The mineralogical assemblage of the fine silt fraction is identical to that of the clays (table 8.4).

Soil Genesis

The combined accumulation of Al, Fe, and soil organic carbon (figures 8.5 and 8.6) in the B horizon is typical of podzols and is the consequence of the arrest of the downward

Table 8.3. Mineralogy of the Clay Fraction (<2 µm) in the Horizons of Soil Profile A, Cliche-Rancourt Site

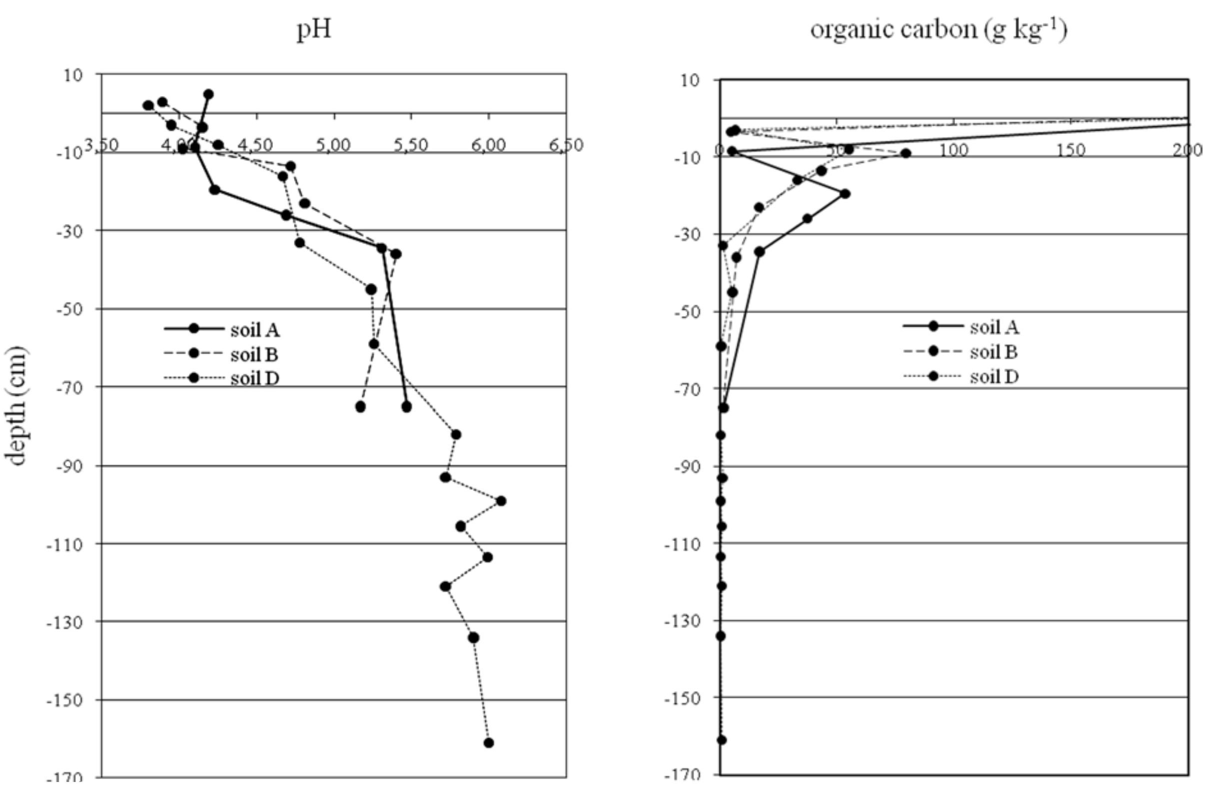
peak (nm)	*K-Feldspar* *0.325*	*Plagioclase* *0.320*	*Amphibole* *0.85*	*Pyroxene* *0.299*	*Chlorite* *1.42*	*Mica-phlogopite* *1.0*	*Vermiculite* *1.4*	*Interstratified** *2.45*
Ae	0.56	0.46	-	-	-	1.17	9.80	1.10
Bhf	0.70	0.67	-	0.37	0.29	1.44	4.82	0.63
Bf_1	0.69	0.88	-	0.39	2.78	2.11	1.22	0.46
Bf_2	0.56	0.56	0.48	0.70	2.74	2.43	0.35	-
IICg	0.77	1.27	-	0.45	1.11	5.68	2.03	-

Measures of peak intensity ratio, I_x/I_{QZ}: peak of a given mineral (I_x) to the 0.426 nm peak of quartz (I_{QZ}).
*Mica-vermiculite interstratified mineral.

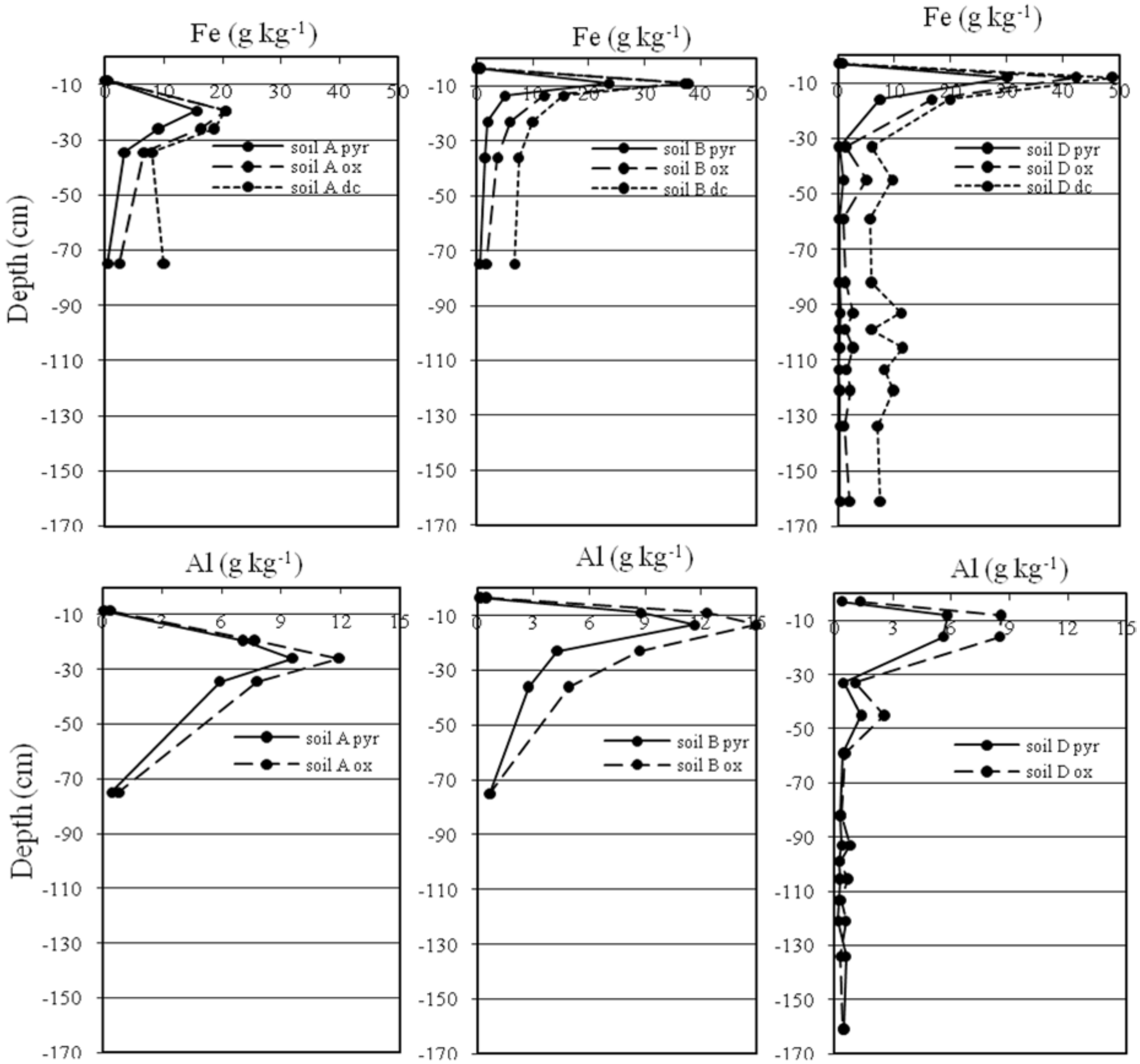
Table 8.4. Mineralogy of Fine Silts (2–20 µm) in the Horizons of Soil Profile A, Cliche-Rancourt Site

peak (nm)	*K-Feldspar* *0.325*	*Plagioclase* *0.320*	*Amphibole* *0.85*	*Pyroxene* *0.299*	*Chlorite* *1.42*	*Mica-phlogopite* *1.0*	*Vermiculite* *1.4*	*Interstratified** *2.45*
Ae	0.21	-	-	-	-	0.50	0.96	0.21
Bhf	0.60	0.13	-	0.13	0.23	0.99	1.27	0.20
Bf_1	0.88	-	0.15	-	1.11	1.93	1.02	0.22
Bf_2	0.92	0.12	0.17	0.12	1.66	2.49	1.11	0.18
IICg	0.94	0.25	-	0.25	1.07	3.53	0.90	-

Measures of peak intensity ratio, I_x/I_{QZ}: peak of a given mineral (I_x) to the 0.426 nm peak of quartz (I_{QZ}).
*Mica-vermiculite interstratified mineral.



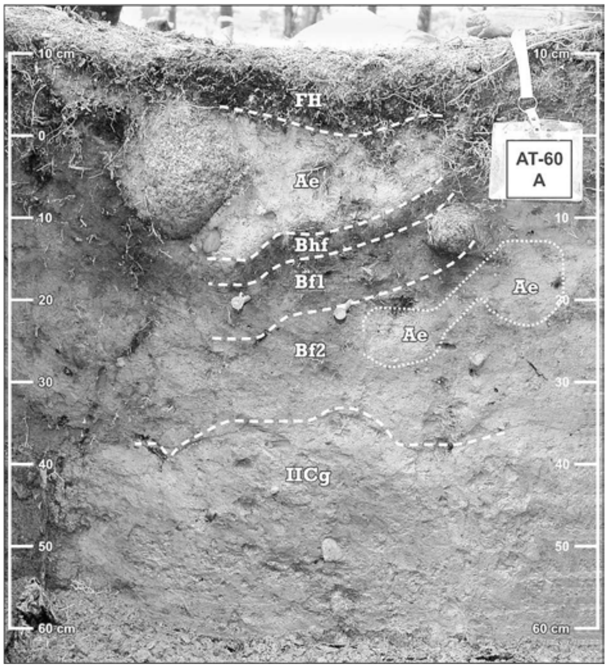
8.5. Values of soil pH in water and organic carbon content in soil profiles A, B, and D.



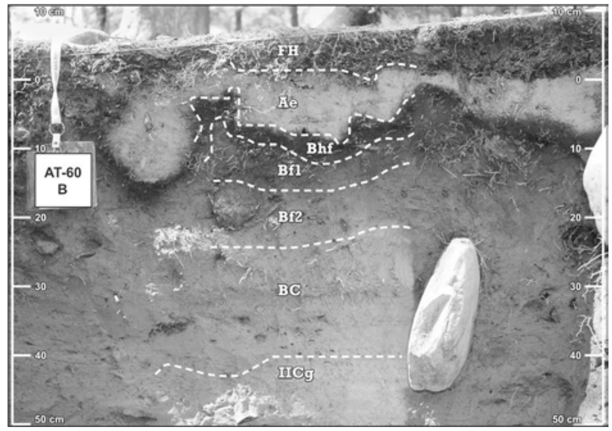
8.6. Concentrations of extractible Fe and Al in soil profiles A, B, and D. The extractants used are sodium pyrophosphate (pyr), acid ammonium oxalate (ox), and dithionite citrate (dc).

migration of organometallic complexes in the soil profile. These organometallic complexes were first created in the eluvial Ae horizon when the percolating soluble organic substances generated in the FH horizons reacted with the Al and Fe ions dissolved by chemical weathering in the top of the mineral horizons (Courchesne and Hendershot 1997). During podzolization, organic carbon, Al, and Fe are redistributed in this manner, thus creating zones of depletion (Ae) and of enrichment (Bhf, Bf, BC) in the soil profile. In podzols, weathering is stimulated by the presence of metal-complexing dissolved organic compounds, either humic substances or simple organic acids, produced during the microbial decomposition of the organic matter accumulating on the forest floor (Lundström 1993). These compounds have the capacity to both corrode the solid mineral phases of soils and to complex the metals solubilized therein. The percolation of these organic acids in the mineral soil profile, and the mineral weathering reactions they trigger, further acidify the surface horizons (see figure 8.5), decrease the bioavailability of the nutrient cations Ca, Mg, K, and Na, and progressively eliminate the most weatherable minerals from the soil surface to the Ae horizon.

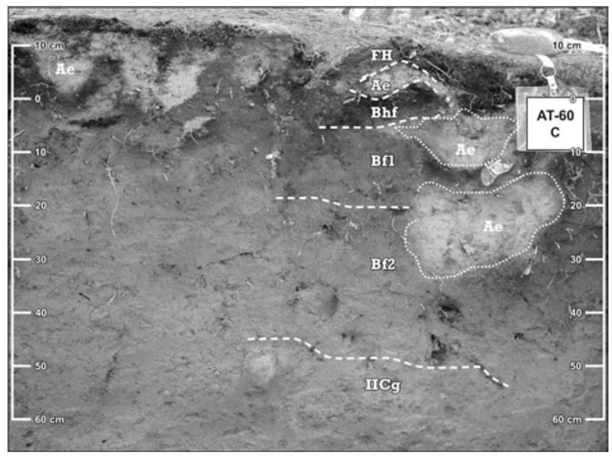
Contemporary Ae horizons thus result from the weathering of a initially thicker layer of parent material so that artifacts present in a 10 cm thick Ae could in fact originate from a 20 cm or more thickness of sediment. In short,



8.7. Ancient pedoturbation in soil profile A.



8.8. Ancient pedoturbation in soil profile B.



8.9. Recent pedoturbation in soil profile C.

pedogenesis can naturally concentrate artifacts in Ae horizons due to volumetric changes, here reduction, taking place as soils form (Brimhall et al. 1991). The formation of podzols is a common process in a cold, wet climate and where an acidic and coarse-textured sediment is colonized by forest vegetation. These environmental conditions prevailed in the past at the Cliche-Rancourt site and are still present. Soil profiles A, B, and C (figures 8.7–8.9) described at the site all belong to the gleyed humoferric subgroup of the podzolic order because of the presence of contrasted mottles in the IICg horizon (Groupe de travail sur la classification des sols 2002). Profile D (not shown) is a dystric brunisol.

Soil Disturbances

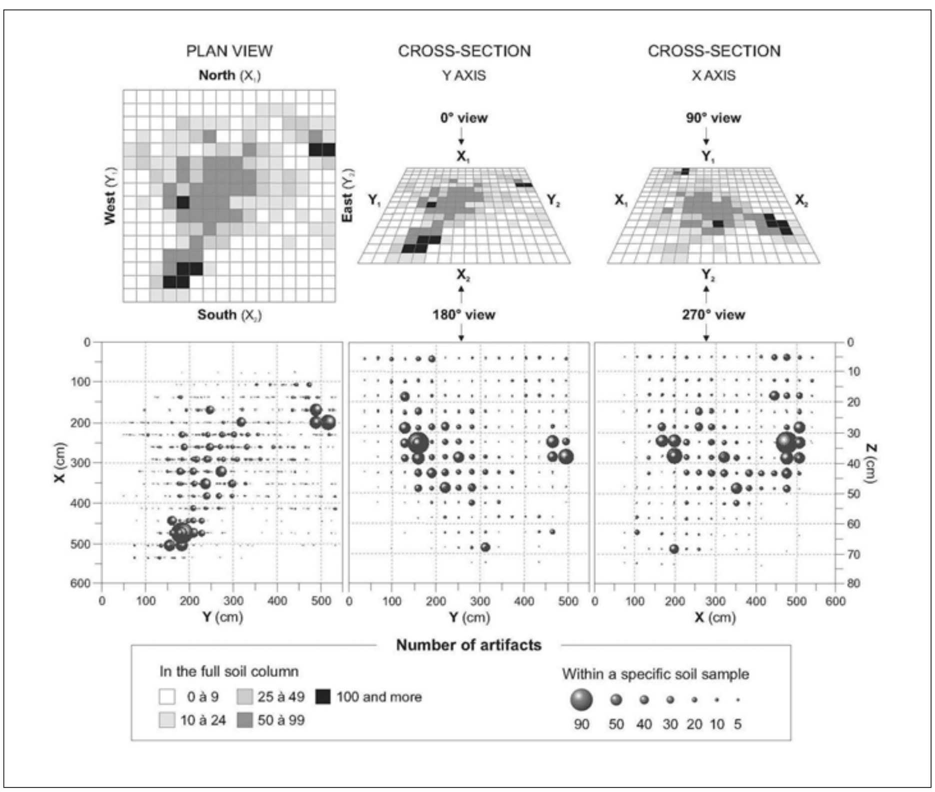
Podzolization, like several other pedogenetic processes, favors the development of soil profiles with individual horizons relatively parallel to the surface of the terrain. Although the soils of the Cliche-Rancourt site tend to follow this pattern, they also repeatedly show the presence of physically disturbed horizons. Pedoturbations result from the action of a range of processes, acting individually or in combination, including the growth of vegetation in some trees, the activity of burrowing animals or insects, and freeze-thaw cycles. In profile A, pedoturbations are seen at the surface of the soil, where the Ae horizon is locally unusually thick (more than 15 cm), at least for this site, as if a spadeful of soil had been taken away (see figure 8.7). The Ae horizon is tightly bordered by a well-developed Bhf horizon, underlining the fact that this superficial pedoturbation is relatively old. Moreover, several isolated masses of Ae horizon are buried at depths of more than 40 cm within the Bf horizon. The Ae horizon of profile B also has morphological features associated with physical disturbances (see figure 8.8). In this profile, the Ae horizon has a high sinuosity, with discrete Ae segments being deeper than wide, as if the horizon was compressed, tipped up, or had undergone lateral pressures. The meandering outline of the Ae horizon is, like profile A, also bordered by a mature Bhf horizon. At the base of the B horizon, and resting on the IICg material, a decimetric block has been set upright by frost action. In profile C an oblong Ae inclusion more than

30 cm deep is buried in the B horizon (see figure 8.9). In the first 20 cm of this profile, multiple pedoturbation features are visible, including a sinuous and sometimes broken Ae horizon together with interpenetrated FH, Ae, and B horizons. Similar recent pedoturbations are present in profile D (not shown).

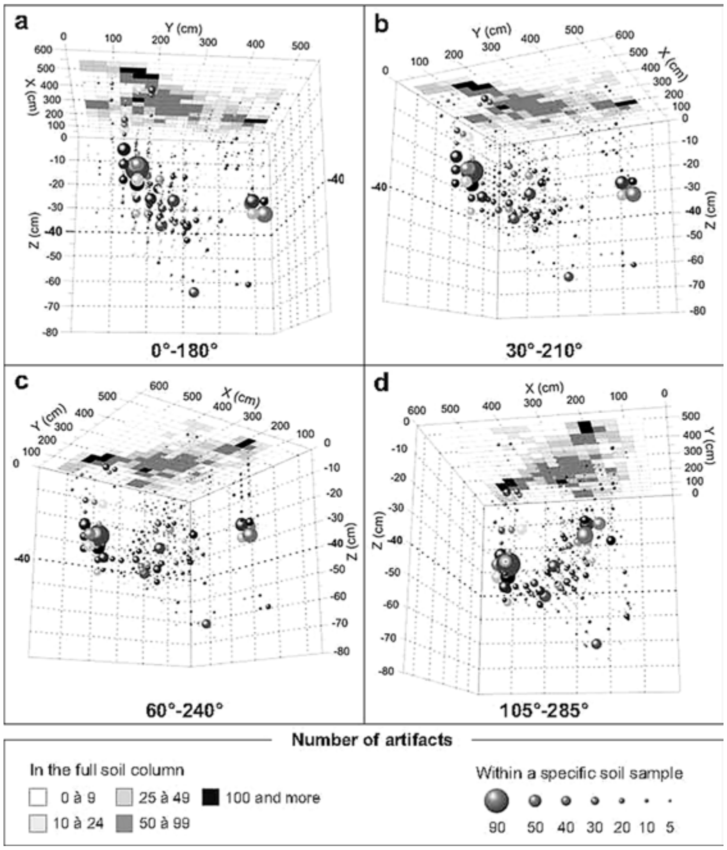
Spatial Distribution of Artifacts

At the Cliche-Rancourt site, the two-dimensional profile distribution of artifacts is illustrated for sixteen adjacent quadrants (AR60 to AU63, for a total surface area of slightly more than 16 m^2) of Area 3 in figure 8.10. These projections clearly show that the artifacts were deeply buried in the soils. The burial is characterized by the presence of artifacts at a depth of more than 75 cm in the profile and by the existence of a bimodal distribution of artifacts. The first distribution mode is the most important and is located in the B horizon, at depths ranging from 30 to 50 cm along the *z* axis. The second mode is not as strong and reveals the presence of artifacts at 60–70 cm in the profile, an unusual depth for the burial of artifacts in soils of the Far Northeast. This second artifact mode corresponds to the interface between the base of the podzolic B horizon and the top of the IICg, a horizon that is significantly denser than the B horizon and contains some artifacts. The plan view of the sixteen quadrants further shows that the artifacts are widely distributed in space, with two specific zones presenting a higher concentration—one in the southwestern corner of the site and a secondary zone in the northeast.

The three-dimensional projections demonstrate even more sharply the extent of the burial processes that have taken place in the Cliche-Rancourt soil after the deposition of artifacts at the ground surface (figure 8.11). For example, the depletion of artifacts in the surface horizons to the benefit of the lower podzolic B horizon (30–45 cm depth) can be seen in the 60–2400 rotation. These projections further reveal the presence of organized spatial structures in the distribution of artifacts. The three-dimensional grouping of artifacts in the soil can indeed be observed in rotations 0–1800 and 105–2850 and takes the form of a curved band or large hook. Moreover, artifact trails spreading from the surface of the soil profile to depths of 30–40 cm are visible in rotations 30–2100 and 60–2400. We submit that the spatial patterns and artifact trails reflect the progressive vertical displacement of individual artifacts in the soil profiles. These conditions are due either to low-intensity,



8.10. Two-dimensional spatial distribution of artifacts from three different perspectives: a, plan view; b, cross-sectional view parallel to the west-east axis; c, cross-sectional view parallel to the north-south axis.



8.11. Three-dimensional spatial distribution of artifacts from four different rotations: a, 180°; b, 210°; c, 240°; d, 285°. The view from the north is set as the reference 0° rotation.

slow and continuous processes or to sudden disturbances acting on large soil volumes, up to several cubic meters at the time, and occurring on an episodic basis over the past 12,000 years.

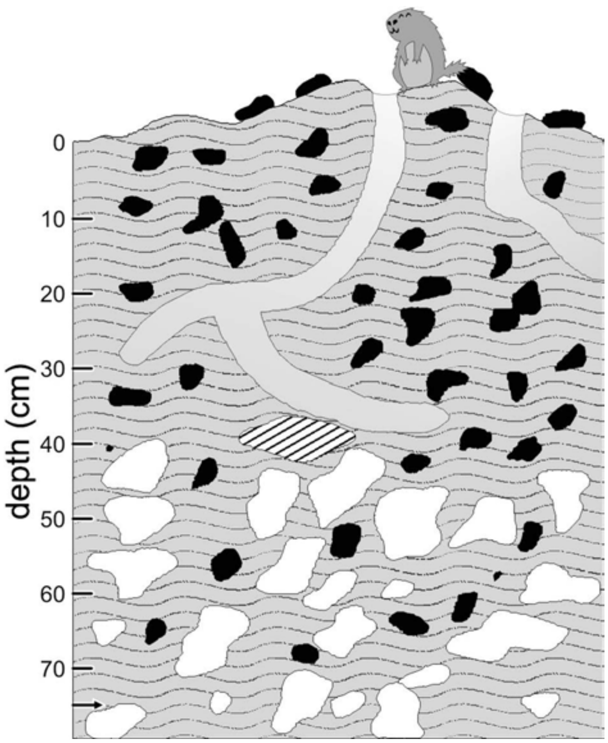
PEDOTURBATION PROCESSES

The role of biomechanical processes, or physical pedoturbations of biological origin, in soil genesis has been known since the end of the nineteenth century (Darwin 1881). The same applies to pedoturbations due to the action of burrowing animals (Branner 1900) and, to a lesser extent, to the effect of freeze-thaw cycles (Tedrow 1966). However, physical pedoturbation, in particular floralturbation and faunalturbation, were not explicitly integrated to theories and models of soil genesis and in the pedoarcheological literature until the end of the twentieth century (Hole 1981; Johnson and Watson-Stegner 1987; Paton et al. 1995). From an archaeological perspective, pedoturbation is critical because it tends to both redistribute artifacts in soil profiles and to obliterate, in part or in full, occupation levels or stratigraphic markers.

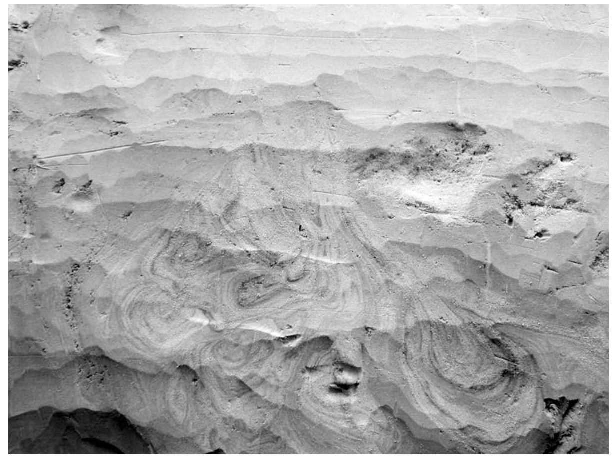
Floralturbation refers to all soil disturbances produced by living plants, in particular by trees. The most obvious type of floralturbation, and probably the best documented, is the uprooting of trees (Schaetzl et al. 1989). Tree uprooting causes the root network to tear the bulk of the soil up together with attached stones and boulders (figure 8.12). The terrains affected by tree uprooting generally have characteristic meter-size pit-mound topography. The progressive filling of the depressions by gravity, wind, or overland flow not only reduces the amplitude of the microrelief but also tends to bury artifacts. Obviously, the uprooting of trees strongly disturbs the soil profiles and thus leaves visible marks such as inverted, twisted, and interpenetrated horizons (Johnson 1990). These features tend to fade away with time, but the horizon mosaic thus created can last for several decades if not centuries. A recent study of more than four hundred tree throws by Bobrovskii (2008) showed that the average soil disturbance depth varied from 40 to 90 cm, with a maximum of 200 cm.

Faunalturbation refers to the contribution of burrowing animals, either invertebrates (ants, earthworms) or vertebrates (moles, wombat), to the physical disturbance of profiles (Hole 1981; Johnson 1993). For example, Paton et al. (1995) showed that earthworms could process soil materials at a rate of up to 200 Mg of soil/ha/yr, making them the most important source of pedoturbation among living

8.12. Floralturbation of a forest soil in the Lower Laurentians, Quebec. The person is 1.92 m tall.



8.13. Faunalturbation of a soil profile. The cross-hatched fragment is an artifact (adapted from Johnson 1989).



8.14. Cryoturbation in a soil of the Rupert River area, Quebec (photograph by Marc Lamarche).

animals. In a laboratory experiment, Armour-Chelus and Andrews (1994) determined that a single earthworm could, in two years, impose a vertical displacement of 24 cm to an artifact initially resting on the soil surface. Earthworms are, however, intolerant to cold environments and to coarse-textured, acidic, or anaerobic soils. The amounts of soil materials displaced by ants (10–60 Mg/ha/yr) and termites (5–30 Mg/ha/yr) during the construction of their nests or mounds are not as large as for earthworms, but they significantly disturb soils by obliterating horizons or homogenizing profiles. Unlike earthworms, ants and termites are almost ubiquitous, thus making their impact more widely distributed (Paton et al. 1995). Pocket gophers disturb the soils by digging a vast network of tunnels in soils (figure 8.13). One consequence of their activity is the selective displacement of soil particles, in particular of centimeter-size fragments (Bocek 1986; Erlandson 1984; Johnson 1989). These particles, when smaller than the inside diameter of gopher tunnels (<6–7 cm), have a high probability of being moved upward to the soil surface during the maintenance of tunnels. In the case of larger fragments, pocket gophers must dig their tunnels around or under them. It follows that these larger fragments tend to selectively move downward in soils, where they form stone lines.

Cryoturbation refers to pedoturbation caused by the combined action soil freezing and thawing (Bockheim and Tarnocai 1998; Ugolini et al. 2006), whether permafrost is present or not. The ideal conditions for cryoturbation are found in imperfectly drained soils and in fine-textured silty sediments in cold environments. Frost heaving, the development of ice wedges, and mass wasting due to solifluction are among the most common types of cryoturbation (Esdale et al. 2001). These cryoturbation processes force soil particles and cultural artifacts to move in the direction of lesser pressure within profiles—that is, vertically upwards (frost heave), vertically downward or radially (ice wedges), or laterally (solifluction)—in response to the internal pressures generated by frost or the downslope movement of soil. Soil horizons are broken, bent, dislocated, or mixed (see figures 8.7–8.9) by the action of cryoturbation, whereas profiles are strongly disturbed by large-scale involutions (figure 8.14), compression, void infilling, and particle segregation phenomena (Dillon and Sorenson 2007; Johnson and Hansen 1974; Ugolini et al. 2006; Washburn 1973).

IMPACT OF PEDOTURBATION ON THE BURIAL OF ARTIFACTS AT CLICHE-RANCOURT

The burial of artifacts at an archaeological site can result from pedoturbation processes that are either synchronous

with or subsequent to their deposition or, alternately, from sedimentation events that follow the deposition of artifacts at the soil surface. Our data on soil texture, bulk density, and mineralogy at the Cliche-Rancourt site point to the presence of a lithological discontinuity in the soil profiles, thus confirming that at least two sedimentation sequences took place at the site. However, the top sandy outwash deposit and the underlying dense silty sediment both contain artifacts from the Early Paleoindian and were thus present before the deposition of artifacts. Detailed observation made at the site did not reveal the presence of eolian deposits or of any other recent sediment burying the artifact-bearing materials. It appears that the suggestion that the burial of cultural remains was the result of a sedimentation phase following the production of artifacts is not viable at Cliche-Rancourt. The remainder of this discussion thus focuses on the role of pedoturbation processes on artifact burials.

Pedoturbation Synchronous with the Deposition of Artifacts

At Cliche-Rancourt, a cold periglacial climate and tundra vegetation prevailed from 12,500 to 12,200 cal BP when the first cultural remains of the Early Paleoindian period were deposited at the surface of the fresh proglacial sediments (P. Richard, personal communication). No data are available on the soil fauna during this first occupation period, but it is assumed that the pedoturbation due to vegetation and soil animals was then minimal because climatic conditions favored the presence of permafrost. In short, cryoturbation is the main pedoturbation process, if not the only one, that could be viewed as synchronous with the production and deposition of Paleoindian artifacts.

Cryoturbation affects the soils of a range of terrestrial environments including periglacial zones, high mountain areas, and landscapes at the margin of glaciers. In these environments, the pedoturbating effects of freezing and thawing cycles are of such magnitude that sedimentary sequences and soil horizons are distorted and inverted, thus throwing confusion into stratigraphic reconstruction and archaeological interpretation. The work conducted by Esdale et al. (2001) at the Dog Creek archaeological site in northern Yukon illustrates the need for a sound understanding of periglacial processes when conducting archaeological investigations in high northern latitudes. These researchers provided evidence of the complex transformation of cryosols, loess deposits, and shattered limestone through the combined action of solifluction, frost heave, and infilling frost cracks. Their observations show that since the mid-Holocene cryoturbation has moved and buried artifacts down to the base of the active layer of the permafrost, at more than 100 cm deep in the soil. They attribute a critical role to solifluction in the burial of artifacts. The infilling of frost cracks by exogenous soil materials rich in artifacts was also invoked to explain the redistribution and burial of cultural remains at Dog Creek. In Nunavik, Todisco and Bhiry (2008) demonstrated how successive solifluction episodes during the late Holocene were able to disturb and bury a Paleoeskimo archaeological site. Field data allowed the quantification of the mean rate of sheetlike solifluction at 1.68–2.86 cm/yr over a period of 350 years. Solifluction in fine-textured glaciomarine sediments was enhanced by longer thawing periods or by warmer/moister summer months and thus promoted the preservation of three superposed archaeological levels. Current studies performed at archaeological sites located along the valleys of the Rupert and Eastmain rivers in Quebec show that cryoturbation activity was strong and that a close association existed between soil physical disturbances and the spatial distribution of artifacts in cryoturbated profiles (M. Lamarche and G. Rousseau, personal communication).

At the Cliche-Rancourt site, climatic conditions conducive to cryoturbation existed when the first artifacts were produced and continued to prevail until 10,000 years ago (Richard 2007). The precise moment of cessation of cryoturbation activity is not known with certainty, but the burial of cultural remains by cryoturbation, if any, must have been restricted to the first hundred years, the very first thousand years at the maximum, of existence of the artifacts. Having said that, several observations support the idea that cryoturbation contributed significantly to the burial of artifacts in the early days of the Cliche-Rancourt archaeological site.

One key observation is the differential vertical distribution of artifacts associated with the two occupation periods. The absence of artifacts from the Late Paleoindian occupation below a depth of 30 cm (except at quadrant N56) indicates that the mechanisms responsible for the translocation of the artifacts of the Early Paleoindian occupation down to

75 cm did not affect the more recent objects. Consequently, if we assume that burial below 30 cm is due to cryoturbation, we logically have to limit their contribution to deep burial to the period that preceded the second Paleoindian occupation, between 12,500 and 11,500 cal BP. This does not exclude the possibility that cryoturbation translocated the artifacts deposited after 11,500 years ago. However, in this case the action of cryoturbation has to be mostly limited to the first 30 cm of the mineral soil profiles.

Besides these stratigraphic markers, other soil features are better explained by invoking cryoturbation rather than bioturbation. Among these is the presence of an almost upright decimetric block situated at the base of the solum in profile B (see figure 8.8). The position of such a large block inclined close to vertical, assuming an initial horizontal deposition, could result either from frost heaving or, more marginally, from tree uprooting. The current depth of frost action in these soils allows for the possibility of heaving but at a slower rate than during colder periods of the Holocene. The presence of artifacts at 75 cm deep (see figure 8.10) further points to the crucial role of cryoturbation because, in this case, no observation made at Cliche-Rancourt convincingly supports the contribution of other pedoturbation processes (see below). The presence of spatial structures in the profile distribution of cultural remains, in particular the curved artifact band between 30 and 50 cm deep, also tends to support the role of cryoturbation (see figure 8.11). These structures not only contain a large proportion of the total number of artifacts uncovered at the site but also are linked to artifact trails connecting the structure to the soil surface. Similar artifact clusters presenting a well-defined spatial organization have been observed at other archaeological sites, and their genesis was associated with cryoturbation (Kellogg 2003). It should be noted that the visible imprints of cryoturbation, some of them dating back to the early Holocene, have mostly been obliterated or erased by more recent pedogenesis. Complete or partial obliteration, or pedogenic overprinting, complicates the demonstration of the cryoturbation effect, notably in strongly developed surface horizons, as acknowledged by Cremeens et al. (1998).

Pedoturbation after the Deposition of Artifacts

Vegetation dynamics and the activity of burrowing animals can affect the physical integrity soils and can, therefore, mobilize artifacts. For example, the numerous indications of physical perturbation identified in the surface horizons of each of the four soil profiles at Cliche-Rancourt all bear the signature of tree uprooting (see figures 8.7–8.9). The most obvious signs of tree uprooting are folded horizons, notably in the Ae horizon of profiles C and D (not shown); intertwined horizons, as in the Ae and B horizons of profiles A and C; uprooting scars, as can be seen at the surface of profiles A and C; and the disordered infilling of pits left by uprooting. At the Hedden site in Maine, tree throws were identified as the main process responsible for the post-depositional burial of artifacts and for their bimodal distribution (25–45 and 60–80 cm) in the soil profile (Spiess et al. 1995). At this site, floralturbation generated folded surface horizons and left broad and shallow devegetated craters in soils. At the Neal Garrison site in Maine, the role of floralturbation was considered minor, though its impact on some soil profiles was acknowledged (Kellogg 2003). At the Cliche-Rancourt site, the physical disturbance of soils by tree uprooting is visible in all studied profiles and probably contributed to the redistribution of artifacts. These pedoturbations were logically initiated by the development of forest vegetation at the site 11,900 years ago (P. Richard, personal communication). Yet soil morphology and the distribution of Late Paleoindian artifacts show that floralturbation was essentially concentrated in the upper 30 cm of the mineral portion of soils and that it left no visible signs of its impact deeper in profiles.

At the Cliche-Rancourt site, pedoturbation due to earthworm activity is minimal because the soil is sandy, poor in organic matter, and acidic, making it a hostile substrate for earthworms. In fact, earthworms were not observed in soils during sampling. Moreover, neither the nature (mor type) nor the structure (weakly granular peds) of the organic FH horizons is representative of soils with active earthworm colonies. Also, there are no strong reasons to believe that earthworm activity was higher in the past, even though the soil pH values were probably less acidic than the current level, as suggested by the pH of the IICg horizon (see figure 8.5).

Other burrowing animals appear to have had a limited impact on the physical stability of the soils at Cliche-Rancourt based on their low abundance and on the few distinctive signs revealing their presence, past or present,

in soils. Soil morphological features nonetheless indicate that the role of large burrowing animals may be locally significant. The presence of large Ae inclusions at a depth of 30 cm in the B horizons of profiles A and C could indeed be interpreted as evidence of faunalturbation. The Ae inclusions would represent cross sections of old and abandoned rodent tunnels that were, at least in part, filled back from above by Ae material. At the Neal Garrison site an ovoid pedoturbated soil zone where the majority of Paleoindian cultural remains were found was similarly interpreted as rodent faunalturbation (Kellogg 2003). Other demonstrations of the role of faunalturbation on the distribution of artifacts were reported for archaeological sites in the United States (Balek 2002; Bocek 1992; Erlandson 1984; Frolking and Leeper 2001). At the Cliche-Rancourt site, faunalturbation is certainly present, but a careful interpretation of soil morphological features confines its action to the upper 30 cm of the mineral soil, similar to the floralturbation. The critical observation that cultural remains from the Late Paleoindian (11,500–10,750 cal BP) were not found at depths beyond 30 cm, except in quadrant N56, further supports the claim that at Cliche-Rancourt pedoturbation due to plants or animals seldom if ever exceeded that threshold depth.

SUMMARY

The archaeological excavations conducted at the Cliche-Rancourt site revealed Paleoindian artifacts deeply buried in the soil profiles. Not only were cultural remains found at a depth of 70 cm and more but their profile distribution followed differential depth patterns depending on whether they originated from the Early or Late Paleoindian periods. Indeed, the artifacts from the latter period were confined to the first 30 cm of the profiles, with the exception of one quadrant, whereas the cultural remains of the former period were widely distributed and reached depths of 70–80 cm.

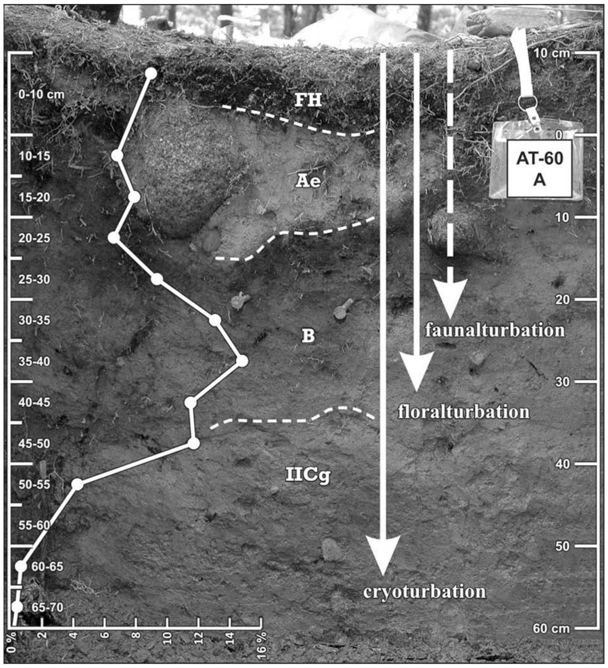
Physical, mineralogical, and chemical analyses of four podzol profiles and examination of the vertical distribution of artifacts from two Paleoindian occupation periods first dismissed the possibility that artifacts were buried by sedimentation accretion phase(s) that followed the production of artifacts. On the other hand, the strong physical disturbance of the surface of soil profiles together with the three-dimensional representation of artifact distribution in soils clearly suggested that pedoturbation, including cryo-, floral-, and faunalturbation, had a significant impact on the postdepositional transport and deep burial of artifacts.

The individual pedoturbation processes operated at different, perhaps synchronous, periods of the Holocene (table 8.5). For instance, cryoturbation dominated immediately after ice retreat and lasted for a few thousand years after deglaciation. Because of the periglacial climate during the Early Paleoindian occupation (12,500–12,200 cal BP), cryoturbation is undoubtedly responsible for the burial of the oldest artifacts at more than 75 cm in soils. and this in a relatively synchronous fashion with respect to their deposition. With climate warming up during the early Holocene,

Table 8.5. Synthesis of Temporal Changes in the Dominant Pedoturbation Processes, Cliche-Rancourt Site

Chronology	*Vegetation*	*Pedoturbation processes*
13,500–11,900 cal BP *(Early Paleoindian occupation, 12,500–12,200 cal BP)*	Desert to tundra (13.5–12.9 ka) Herb tundra (12.9–12.4 ka) Dwarf birch tundra (12.4–11.9 ka)	cryoturbation faunalturbation
11,900–9,500 cal BP *(Late Paleoindian occupation, 11,500–10,750 cal BP)*	Open-canopy forests (11.9–9.5 ka) Balsam fir/alder (11.9–11.5 ka) White birch/fir (11.5–9.5 ka)	floralturbation
9500–7300 cal BP	Closed-canopy mixed forests	
7300 cal BP to present	Sugar maple and yellow birch closed-canopy forests	

Chronological ranges are given for the major vegetation types identified through pollen analysis of the sediments of a nearby lake. Pollen analyses by P. Richard.



8.15. Synthesis of the vertical distribution in the dominant pedoturbation processes at the Cliche-Rancourt site. The solid line with circles represents the abundance of chert artifacts from the Early Paleoindian. Soil profile A is used as the reference background.

the intensity of cryoturbation dynamics decreased, and it had much less effect on the burial of cultural remains, as shown for artifacts from the Late Paleoindian occupation (11,500–10,750 cal BP). Floral- and faunalturbation subsequently became dominant as permafrost melted, plants were established, and forest vegetation invaded the landscape. They are now the main potential pedoturbation agents, in particular tree throws, although clear evidence for the action of faunalturbation by burrowing animals on the postdepositional burial of Paleoindian artifacts is meagre and indirect (hence the dashed line in table 8.5).

Pedoturbation also affected distinct portions of the soil profiles (figure 8.15). Although cryoturbation certainly had an impact on the whole soil depth, evidence from the vertical distribution patterns of Late Paleoindian artifacts shows that floral- and faunalturbation was concentrated at the surface of profiles and essentially limits the extent of soil disturbances by plants and animals to the top 30–50 cm. At Cliche-Rancourt, this soil dynamic created a complex soil disturbance signal containing both spatial and temporal components. On top of that, subsequent soil genesis and podzolization processes obliterated, at least in part if not completely, the fingerprints and evidence left by the various pedoturbation types, thus producing a complex soils palimpsest to decipher. Complementary analyses are needed to consolidate this view. Among others, establishing nonequivocal and systematic spatial correspondences between pedoturbation features and the position of artifacts in soil profiles would constitute a rigorous approach to test our working hypotheses on the role of pedoturbation on these deep burials.

This pedological study of the Cliche-Rancourt site underlines the need for a detailed understanding of the environmental conditions prevailing when artifacts are deposited, and of their temporal evolution, notably in areas affected by severe environmental changes during the late Pleistocene and Holocene. When combined in an investigation of past and present pedogenetic processes, this knowledge is key to the analysis of sedimentary sequences and of artifact distribution at archaeological sites. The early detection of pedoturbation, and of the potential for the burial of artifacts, thus constitutes a decisive step for any archaeological study.

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CHAPTER IX

The Bull Brook Paleoindian Site and Jeffreys Ledge

A Gathering Place near Caribou Island?

Brian S. Robinson

Large Paleoindian sites in the Northeast have often been interpreted as camps associated with communal caribou drives (Ellis and Deller 2000:243; Gramly 1982; MacDonald 1968:147; Spiess 1979, 1984:282). Large sites in wooded areas, south of the tundra, raised questions about the appropriateness of the caribou-drive model for the woodland variety of caribou (Curran 1984:6; Dincauze 1993:48; Dincauze and Curran 1983; Dincauze and Jacobson 2001:122; Levine 1997). Greater emphasis on microenvironmental conditions could support both increased abundance of caribou (Newby et al. 2005; Spiess et al. 1998) and broader-based resource exploitation (Curran 1984:6; Curran and Grimes 1989:59), emphasizing potential variability associated with local environments. Here I develop a microenvironmental model for the Bull Brook Paleoindian site in Ipswich, Massachusetts, suggesting that a briefly exposed maritime island (now a submerged fishing bank called Jeffreys Ledge) may have supported an unusually large and predictable caribou migration (Pelletier and Robinson 2005; Robinson et al. 2009). Could a long-vanished "Caribou Island" help to explain Bull Brook?

BULL BROOK AND PALEOINDIAN BACKGROUND

The Bull Brook site is both the largest Paleoindian occupation site in North America and the most highly structured in terms of the number and spatial organization of discrete artifact clusters or activity loci. Excavated by a group of dedicated avocational archaeologists and reported in the 1950s (Byers 1954; Eldridge and Vaccaro 1952; Jordan 1960), the site has long been one of the premier candidates for a large Paleoindian aggregation (Curran 1999:6; Dincauze 1993; Grimes 1979; Spiess et al. 1998). Recent reanalysis supports the interpretation that the thirty-six activity loci arranged in a large circle represent a single organizational event (Robinson et al. 2009). New evidence indicates concentrically organized activities, with an inner circle of six to eight loci dominated by biface production, drills, and flakeshavers (limaces) and an outer ring of loci dominated by endscrapers and gravers among other processing tools. The circular camp and concentric patterning "emphasize the cohesiveness of the group camping together" (Whitelaw 1991:165) and the coherence of group activities. Large-scale organization provides an interpretative platform for a variety of inquiries, including the much-debated subsistence

base. Like all models this must stand the test of time, but here we begin with the premise that Bull Brook represents an unusually large gathering of people at an organized event (Robinson et al. 2009).

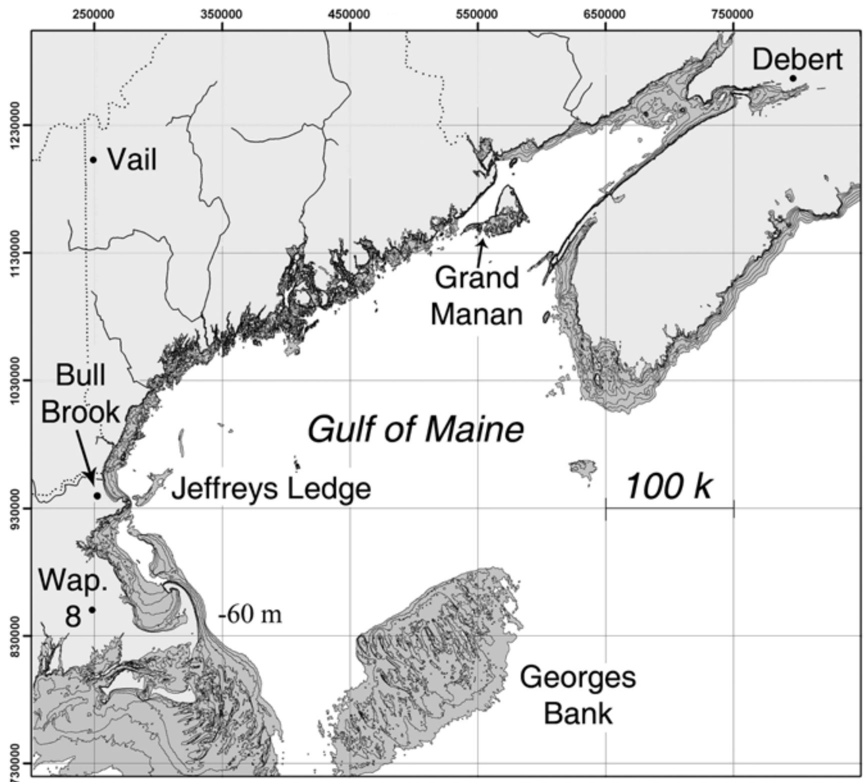
New radiocarbon dates from Bull Brook (Robinson et al. 2009:425) employed the recently developed process of dating calcined bone (Lanting et al. 2001). Two samples of calcined bone from Bull Brook returned dates of 10,410 ± 60 ^{14}C yr BP (Beta 240629, 10,700–10,100 cal BC, at two sigma) and 10,380 ± 60 ^{14}C yr BP (Beta 240630, 10,670–10,040 cal BC, at two sigma). The cultural context of the calcined bone is not in question, the "old wood problem" associated with charcoal is not an issue, and there is at present no reason to suspect the accuracy of the calcined bone dates (Naysmith et al. 2007). Although these are the only potentially accurate dates for the Bull Brook occupation, further testing is needed to confirm that the calcined bone and charcoal dates are equivalent given that the method is relatively new (Robinson et al. 2009:425).

In a previous article (Robinson et al. 2009:424) I attributed the Bull Brook site to the Gainey/Bull Brook phase, which inappropriately combined what had previously been described as two regional phases representing the earliest point styles in the Great Lakes and New England, respectively (Curran 1999:7; Ellis and Deller 1997:21; Spiess et al. 1998:235). For a number of reasons, especially the overall regional separation, it is better to keep the terms separate as originally defined (Ellis and Deller 1997; Grimes et a1.1984). The "phase" terminology provides a useful shorthand but also risks the reification or solidification of apparent cultural boundaries based on too little evidence. If correct, the new radiocarbon dates from Bull Brook would place it late within the projected temporal range of the Bull Brook phase between approximately 11,000 and 10,500 ^{14}C yr BP (Curran 1999:6–7; Spiess et al. 1998:238). This is in accord with the recent effort to subdivide the Bull Brook–like assemblages in the Northeast into earlier and later groups of sites (Bradley et al. 2008). However, there is considerable overlap in metric and nonmetric attributes between the proposed styles (Bradley et al. 2008:164), making it difficult to evaluate sites assigned to each group.

Paleoindians adapted to different resources across the country (Cannon and Meltzer 2004; Meltzer 1993). Caribou (*Rangifer tarandus*) was an early focus for northeastern Paleoindian studies at the Debert site in Nova Scotia (figure 9.1), with caribou adaptation inferred near glacial ice (MacDonald 1968:147). Caribou foot bones were later identified among calcined bone recovered at Bull Brook, the Whipple site in New Hampshire (Curran 1984), and at Udora in Ontario (Spiess et al. 1985; Storck and Spiess 1994). Beaver (*Castor canadensis*) was also identified at Bull Brook (Spiess et al. 1998), and hare (*Lepus* sp.) and arctic fox (*Alopex lagopus*) at Udora (Storck and Spiess 1994:128). Mammoth and mastodon bones have been recovered on the sea floor just south of Cape Ann in the Gulf of Maine (Oldale et al. 1987) but are probably too early for the human occupation of Bull Brook.

In the Great Lakes region "a restriction of larger sites over time to more northerly areas of southern Ontario, and specifically on the Algonquin strandline," is consistent with communal hunting practices at some large sites, whereas smaller sites may represent more individualistic hunting practices (Ellis and Deller 1997:17). The importance to caribou of glacial ice patches during the summer provides further attraction to the north and clues to seasonality for upland or high-latitude regions (Hare et al. 2004:261; Pelletier and Robinson 2005). In the Northeast, the Debert site (MacDonald 1968), the Vail site in northern Maine (with its associated kill site, Gramly 1982, 1984), and the Jefferson sites in northern New Hampshire (Boisvert 1999) are among northern and upland sites that are close to tundra or alpine microenvironments (Borns et al. 2004; Davis and Jacobson 1985; Newby et al. 2005; Stea et al. 1998).

The Bull Brook site on the coast and the DEDIC/Sugarloaf site on the Connecticut River in western Massachusetts (Chilton et al. 2005; Gramly 1998) are more clearly situated within lowland forested areas and thus may serve as stronger tests for the suitability of wooded environments for communal caribou hunting, or alternative subsistence practices. For both of these locations the presence of caribou is demonstrated by calcined faunal remains, directly associated with Bull Brook and at the Whipple site, 50 km northeast of DEDIC/Sugarloaf (Spiess et al. 1985). The question again is not whether caribou were present but whether their numbers were high enough and migrations sufficiently predictable to support communal hunting practices. Alternative explanations for large Paleoindian sites in addition to communal hunting include the accumulation of multiple



9.1. Gulf of Maine showing exposed land at lowstand, 60 m below present sea level, at approximately 10,500 ^{14}C yr BP.

occupations (Byers 1959; Jordan 1960), aggregation for a variety of social needs (Anderson 1995:11; Dincauze 1993:51; Wobst 1974:152), central places for broader-based resource procurement (Curran 1984:6; Dincauze and Curran 1983; Dincauze and Jacobson 2001), and marshalling areas for pioneers on a new landscape (Dincauze 1993:51). These factors may operate together in different combinations. The social contexts at Bull Brook are discussed in more detail elsewhere (Robinson et al. 2009). Here we focus on the resource base and hunting practices.

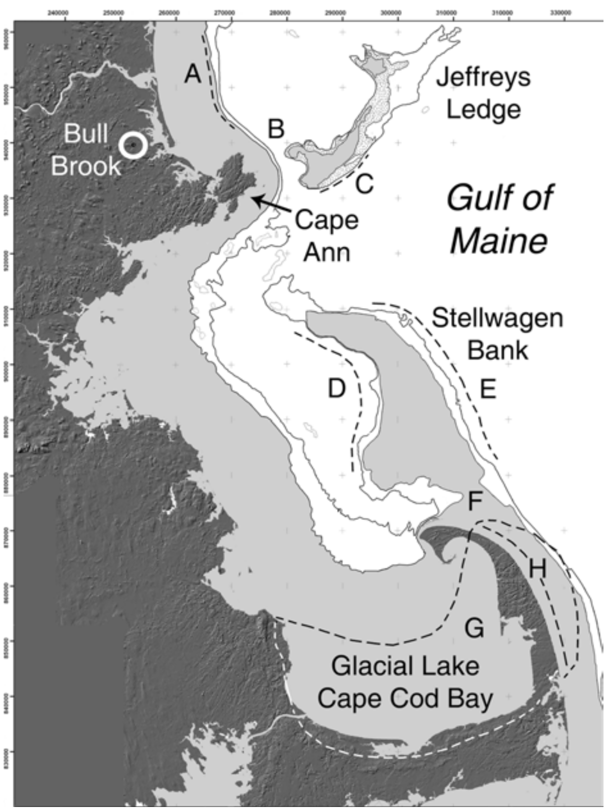
BULL BROOK AND JEFFREYS LEDGE ON THE PLEISTOCENE COAST

Bull Brook is unusual for its near-coastal location. Paleoindian maritime adaptations are proposed for the Champlain Sea (Loring 1980; Robinson 2009:87, and F. Robinson, this volume; see also Pintal, this volume), but Bull Brook would have been about 18 km from the sea and, thus far, there is no evidence that maritime resources were a major draw in this region. Oldale (1985a:145–146) suggested that coastal resources were not rich in the area of Bull Brook because of the "near-catastrophic shoreline regression and transgression along the western Gulf of Maine." However, it was also suggested that the edge effect of an unstable coastline supported higher productivity of terrestrial animals (Curran 1984:19).

Bull Brook is currently situated adjacent to a saltwater marsh that pinches out in a constricted valley with steep slopes (Robinson et al. 2009). The constricted valley may have been suitable for an animal drive and trap area. The salt marsh is the product of the past 4,000 years of sea level rise, and it is not known whether the valley would have been more or less constricted prior to marine encroachment. The modern salt marsh opens out into the Plum Island estuary, where bar formation has obscured older landforms. The Pleistocene shoreline lay approximately 18 km east of Bull Brook, representing a significant area of now-submerged Pleistocene landscape. Recent high-resolution geological mapping off the mouth of the Merrimack River south to Cape Ann shows bedrock outcrops, braided channels of the Merrimack River, estuarine deposits just north of Cape Ann, and a thickening of Holocene sediments to the south, near Cape Ann (Barnhardt et al. 2009). The most provoca-

tive offshore feature with regard to the present study is Jeffreys Ledge, situated immediately off Cape Ann. Jeffreys Ledge was an island when relative sea level was at its lowest level at approximately 10,500–11,000 ^{14}C yr BP (figures 9.1 and 9.2) (Barnhardt et al. 1995; Kelley et al. 1992; Oldale 1985b). The exact date and elevation of the lowstand of sea level are critical factors for testing relationships with the Bull Brook occupation.

Several factors make Jeffreys Ledge an intriguing association with Bull Brook. Although the mainland of central New England was forested during the Younger Dryas (Davis and Jacobson 1985; McWeeney 1994; Newby et al. 2005), cold sea surface temperatures would have influenced near-coastal vegetation and especially a narrow, exposed maritime island (Schauffler and Jacobson 2002:248; Shuman et al. 2002:1782). If the exposed island was more tundra-like in vegetation, it may have provided summer forage for caribou. The exposed area of Jeffreys Ledge would have been approximately 230 km^2 at 60 m below sea level, or 130 km^2 at 54 m below mean low tide (figure 9.2), making it a potentially substantial land mass. At 55 m below sea level Jeffreys Ledge was separated from the mainland by a 2.5 km wide channel that may or may not have been bridged by a tombolo. Caribou swim as much as 6 km during migrations, selecting narrower water crossings when available (Spiess 1979:110). On St. Paul Island, an island of comparable size (91 km^2) in the Bering Sea, caribou reached a year-round population of 2,046, although island populations are often unstable (Gunn et al. 2003:3; Guthrie 2004:747). If conditions were right, Jeffreys Ledge could have supported a substantial caribou population, providing an unusual microenvironment notable for its contrast with the nearby mainland.



9.2. Features of the southern Gulf of Maine at the late Pleistocene lowstand. Modern bathymetry is shown at 50 m below sea level (shaded gray) and 60 m below sea level (outer contour line). The stippled area on Jeffreys Ledge represents added area at 54 m below sea level. A, dashed line, Merrimack River delta; B, 20 m deep channel between Cape Ann and Jeffreys Ledge at the lowstand; C, dashed line, spit bar on Jeffreys Ledge; D, Holocene sand; E, outwash from a later position of the South Channel lobe of the Laurentide glacier; F, Narrow neck of Stellwagen Bank; G, Glacial Lake Cape Cod Bay; H, outwash from an earlier position of the South Channel lobe of the Laurentide glacier, forming the outer arm of Cape Cod over glacial lake deposits (sources: A, Oldale et al. 1983; C, Oldale 1985b; D, F, Uchupi 2004; E, H, Oldale 1994; G, Poppe et al. 2006).

The plausibility of this scenario is enhanced by the unusual character of both the Bull Brook site and Jeffreys Ledge. Bull Brook is the largest Pleistocene gathering site in North America, located directly opposite one of only two large accessible islands in the Gulf of Maine at the low stand, the other being Grand Manan Island in the Bay of Fundy (see figure 9.1). The long and narrow shape of Jeffreys Ledge increases the impact of cold sea surface temperatures on island vegetation. If suitable for grazing animals, the configuration of the island and caribou behavior may also have provided a uniquely predictable resource (for New England) when the caribou moved ashore into woodlands for the winter. It is at this time that cooperative hunting would have been most effective in proximity to Bull Brook. This scenario implies a fall/winter occupation of Bull Brook (Curran and Grimes 1989), a point of origin for the alleged caribou drive, and a likely path along the north slope of the bedrock rise that constitutes Cape Ann. If animals were driven to the topographic funnel immediately adjacent to Bull Brook, a maximum drive distance of approximately 25 km is implied from the eastern edge of Cape Ann, although natural geographic features may

have cut the effective drive distance in half (Robinson et al. 2009:439). A fall/winter occupation at Bull Brook may also explain the distance of the site from the point at which caribou would have come ashore near Cape Ann. Although animals could have been taken nearer the shoreline, a large winter camp would have required a suitably large inland landform, protected from cold coastal winds during the Younger Dryas. Communal hunting would have increased the hunters' ability to direct the herd to a suitable capture area near the occupation site.

The new radiocarbon dates for the Bull Brook site (ca. 10,400 ^{14}C yr BP) place it within the Younger Dryas period at 10,800–10,000 ^{14}C BP (Muscheler et al. 2008), or 12,900–11,700 cal BP (Rasmussen et al. 2006). The Bull Brook date approximates that of the proposed lowstand at circa 11,000–10,500 ^{14}C yr BP (Barnhardt et al. 1995; Kelley et al. 1992) but dates back to 12,000 ^{14}C yr BP are also cited for the lowstand, including a date of 11,900 ± 110 from the lagoon behind the barrier spit on Jeffreys Ledge (Oldale et al. 1993:40).

Sea level during the lowstand for the central Gulf of Maine is approximately 55 m below that at present (Barnhardt et al. 1995). Oldale (1985b) used the submerged barrier beach on Jeffreys Ledge to estimate a depth of 50 m for the lowstand (Oldale et al. 1993:38). The difference between -54 and -50 m represents a substantial difference in the size of the proposed island (see figure 9.2), with the actual depth at about 10,400 ^{14}C yr BP being a critical factor.

The southwestern portion of the Gulf of Maine has a complex history reflected in the Pleistocene landscape. About 18,000–14,000 ^{14}C yr BP the glacier receded northward over Cape Cod in a series of lobes. Fresh water trapped between the Cape Cod Bay lobe of the glacier and earlier moraines formed Glacial Lake Cape Cod Bay (see figure 9.2) and accompanying lacustrine sediments (Oldale 1992; Poppe et al. 2006). A series of deltas deposited from the east side into the glacial lake formed the lower or eastern arm of Cape Cod. Kettle hole lakes dot the modern surface of these deltas on Cape Cod. The Provincetown Hook at the end of Cape Cod represents more recent bar deposit (ca. 6000 cal BP; Poppe et al. 2006:52).

The formation processes of Cape Cod were partly replicated as the glacial lobes retreated (Oldale 1994:10). Instead of deltas deposited into a glacial lake, outwash deposits that form Stellwagen Bank were probably deposited above sea level (Oldale 1994:12). Kettle hole lakes probably dotted the surface of Stellwagen Bank during the lowstand, as on modern Cape Cod (Oldale 1994:13). Stellwagen Bank is of interest to the present problem for its resemblance to Jeffreys Ledge. If the case is made that Jeffreys Ledge represents a Younger Dryas marine island, would Stellwagen Bank have provided a similar habitat? At 50 m below sea level, Stellwagen Bank would be attached to the mainland. However, like Cape Cod, later hook-shaped bar deposits formed at each end, and the narrow neck at the southern end of Stellwagen (see figure 9.2F) may consist of later Holocene deposits (Uchupi 2004:332, 337, Profile 2). Stellwagen may have provided open vegetated areas attractive to caribou, or it may have been part of the wooded mosaic within the southern range of caribou (Newby et al. 2005), representing an extensive Pleistocene landscape that is largely drowned. There is ample room for other Paleoindian sites in this area, within the broader range of southeastern New England fluted point sites such as at the Wapanucket site (Bradley and Boudreau 2006; Robbins 1980).

Jeffreys Ledge was formed during a readvance of the Laurentide ice sheet that deformed existing sediments and deposited end moraines. "The moraines are inferred to be composed mostly of subaqueous ice-contact stratified drift and outwash deposits" (Oldale 1985c:194). The sea floor east of Jeffreys Ledge is scarred by furrows from icebergs, suggesting limited reworking of the bottom since glacial times. The drowned barrier spit on the southeast side of the ledge (see figure 9.2C) is interpreted as a regressive barrier formed during the early Holocene low sea-level stillstand (Oldale 1985b:375). The crest of the barrier spit is "within 1 or 2 m of 50 m" below sea level (Oldale 1985b:376), and it is from this that Oldale inferred the elevation of the lowstand. The barrier is 2 km wide, 10 km long, and as much as 20 m thick, demonstrating the ample supply of sediment available during the late Pleistocene (Kelley et al. 2005; Oldale 1985b:376). When sea level was at the lowstand, the high sediment load may have created a tombolo or other bar deposits that narrowed the 20 m deep channel between Jeffreys Ledge and Cape Ann, but the current deeper basin suggests that sediments are now scoured free in this area.

The present bathymetric configurations of Jeffreys Ledge and Stellwagen Bank are probably close to the shape of the Pleistocene islands or capes, although precise sea level elevation at the time of the Bull Brook occupation remains a critical variable. If a maritime caribou habitat, Jeffreys Ledge would be a suitable resource base to support a caribou drive and to justify large-scale communal hunting at Bull Brook. Bull Brook does not likely represent a typical annual event, however, and if the model of a resource-rich coastal island is accurate, there should be other hunting grounds, at other scales of hunting, on a Pleistocene landscape that is now partly submerged and partly subaerial.

IMPLICATIONS OF THE MARITIME ISLAND MODEL

If the maritime island model is correct, then both Bull Brook and the maritime island are unusual cases. Meltzer (1993:305) noted that Clovis groups may have been "*opportunists* in relation to large terrestrial faunal resources," and this would certainly be the case if the gathering at Bull Brook took advantage of a large and uniquely predictable concentration of caribou. On the other hand, in support of a regional pattern, if the restriction of most large sites to more northerly areas is evidence of communal caribou hunting (Ellis and Deller 1997:17), then Bull Brook may be more like the exception that proves the rule.

"Caribou Island" is only a model that would help to explain the coastal location of a large aggregation site and its proximity to an unusual submerged island. The model has the advantage of having multiple testable propositions, including correlations in time, depth of the maximum lowstand of sea level, and dependence on a suitable habitat on the proposed maritime island. It also highlights unusual conditions toward the southern range of caribou habitat that may not apply to other interior sites, such as the DEDIC/Sugarloaf site, emphasizing the variety of geographic and environmental factors that may have been utilized.

Finally, I want to distance this exploratory model from the grander debate about whether all Paleoindians were big-game hunters (Meltzer 1993). If every inference in this chapter turned out to be correct, it would lend support to Spiess's (1984:282) proposal that "the largest and longest-lived New England Paleo-Indian population gatherings are associated with caribou drive-hunting." This generalization was accompanied by another, however: "There is such a diversity of ethnographically known peoples with caribou-dependent seasonal adaptations in their seasonal rounds that we cannot realistically say that caribou hunting tells us *anything* about the rest of the year's adaptations" (Spiess 1979:131). The goal here is not to demonstrate a uniform theory but to explore the range of possibilities and test them when possible. "Caribou Island" is added to the repertoire of Paleoindian subsistence possibilities, along with beaver, fish, birds, and other edibles.

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CHAPTER X

Between the Mountains and the Sea

An Exploration of the Champlain Sea and Paleoindian Land Use in the Champlain Basin

Francis W. Robinson IV

Researchers have made many notable gains in understanding northeastern Paleoindian lifeways over roughly the past quarter century, or since the publication of the last compilation volumes dealing largely or specifically with northeastern Paleoindians (Eastern States Archeological Federation 1984; Ellis and Lothrop 1989; see also Newman and Salwen 1977). Many of these gains have come in the form of increasingly refined culture-historical frameworks (Spiess et al. 1998:220–222), the most elegant of which was recently explicated by Bradley et al. (2008). Indeed, even as late as the mid-1980s many still doubted the existence of a distinct Late Paleoindian period in the Northeast (Doyle et al. 1985; Petersen et al. 2000) east of the Great Lakes region, and theories asserting an interregnum in the human occupations of the Northeast after the Paleoindian period still had some currency, though they began to be refuted widely around that time (Doyle et al. 1985; Petersen and Putnam 1992; Robinson and Petersen 1992).

The documentation and reporting of sites have also increased fairly rapidly, as have reanalyses of older sites, including reanalyses conducted by me and my colleagues (e.g., Robinson 2008, 2009; Robinson and Crock 2008; see also Crock and Robinson, this volume). Nevertheless, although a few important synthetic treatments have appeared (e.g., Curran 1999; Gramly and Funk 1990; Meltzer 1988; Petersen 2004; Spiess et al. 1998), a new suite of environmental research (e.g., Newby et al. 2005), refined and ongoing lithic identification research (e.g., Burke 2002, 2006a, 2006b; Pollock 1987; Pollock et al. 1999; Pollock et al. 2008; Robinson et al. 2009), and better chronometric correlations, among other avenues, provide new opportunities for addressing older but still salient questions as well as enabling synthesis in potentially important ways. It is my intention to address several of these issues here, focusing on the eastern side of the Champlain Basin.

This chapter begins with a brief summary of my recent reanalysis of the Reagen site (more detailed treatments are presented in Robinson [2008, 2009, 2011]). After this summary I examine the Champlain Sea and its potential importance to Paleoindian groups. The chapter concludes with a brief look at ethnographically documented subarctic and boreal forest Native groups in order to explore analogies with which to assess the movements, subsistence strategies, and lifeways of Native American groups over the course of the Paleoindian period.

THE REAGEN SITE REVISITED

The Reagen site was one of the first identified and reported Paleoindian sites in northeastern North America (Howard 1935:115, 119; see Robinson 2008, 2011; Robinson and Crock 2008). It began to be well known locally after Benjamin Fisher's and William Ross's avocational investigations there in the early part of the twentieth century. It also appears to have been investigated even earlier by George Perkins, anthropologist and geologist at the University of Vermont (Haviland and Basa 1974), although there are no notes that attest to his findings (Robinson 2008). As early as 1934, Edgar B. Howard, the principal excavator of Blackwater Draw, heard word of the Reagen site and mentioned it in a then-seminal publication on "Early Man" in North America (Howard 1935:115, 119). Later in time, he apparently visited the site with Fisher. Unfortunately, only small portions of several of Fisher's archived letters mention this visit (Robinson 2008).

Despite these earlier investigations, the Reagen site first received widespread scholarly attention when William Ritchie visited the Reagen locality in 1950 and subsequently published his research on the assemblage in *American Antiquity* in 1953 (Ritchie 1953, 1957; see Wormington 1957). Thereafter, the site was referenced widely in regional summaries, including Volume 15 of the Handbook of North American Indians (Funk 1978). It served as an early testament to the antiquity of human occupations in the Northeast and was initially used to characterize northeastern Paleoindian archaeological sites generally (e.g., Mason 1962; Ritchie 1957, 1965; Snow 1980; Willey 1966:50; Wormington 1957).

As time went on, however, and more Paleoindian sites were discovered and documented in the Northeast, the Reagen site increasingly came to be viewed as an anomaly (Snow 1980). Although "fluted" points did make up a small portion of the assemblage, other projectile points recovered from the site could not be placed within any yet-developed typology, and other artifacts forms, particularly the steatite pendants recovered from Reagen, were and continue to be unique among North American Paleoindian sites (see Crock and Robinson, this volume).

In the 1970s and early 1980s, Robert Funk and others recognized that Reagen actually appeared to be a multi-component site, and they tentatively attributed some of the artifacts to then-poorly understood Late Paleoindian period manifestations (Funk 1976, 1978, 1996). Unfortunately, by that time the Reagen site assemblage was scattered among several institutions and private collections and was largely unavailable for direct study.

Ritchie (1953, 1957, 1965) had also proposed that the Reagen site and the Champlain Sea were coeval and could be directly correlated. After several less than successful quantifications of the available data, however, he eventually appears to have abandoned the effort. Thus, the potential of a direct connection between Reagen and the Champlain Sea was yet one more aspect of the site that was left enigmatic.

Following on from the work begun by the late James Petersen of the University of Vermont, I conducted a complete reanalysis of the extant Reagen assemblage as well as a recontextualization of the site in light of the plethora of environmental and archaeological data that has emerged since Ritchie's time. Using identifiable diagnostic artifacts, I was able to place the Reagen site into a broad but demonstrable northeastern Paleoindian synchronic and diachronic framework, in most instances closely following the work of Bradley et al. (2008). These diagnostic artifacts indicate that people attributable to three (and, more tentative, four) recognized subperiods of the broader Paleoindian period visited the Reagen site (Robinson 2008, 2009). These occupations cumulatively spanned approximately 1,700 calendar years, clustering toward the end of the taxonomic sequence defined by Bradley et al. (2008) at the end of the Pleistocene epoch and the beginning of the Holocene epoch.

Archival, petrographic, and other research suggests that the Reagen site or a location very near the Reagen site was a quarry source for the enigmatic "Reagen chert" so prominently represented in the Reagen assemblage (Robinson 2008). The research into this important aspect of the Reagen site is ongoing.

Importantly, I also utilized a suite of recent Quaternary geological and environmental research to place the Reagen site within its appropriate environmental context during the Pleistocene/Holocene transition, especially its relationship to the Champlain Sea. The implications of this re-

search not only for the people utilizing the Reagen site but also for Paleoindians throughout the Paleoindian period in the Northeast are the primary subjects of this chapter.

PALEOINDIANS, THE CHAMPLAIN BASIN, AND THE CHAMPLAIN SEA: A REVIEW OF PREVIOUS RESEARCH

A direct connection between Paleoindians and the Champlain Sea was first formally proposed by Ritchie during his initial investigations of the Reagen site and other regional Paleoindian sites in the early and mid-1950s (Ritchie 1953, 1957). Ritchie's primary interest seemed to lie in the potential for an indirect dating mechanism for the Paleoindian occupations of the Northeast. This technique had been employed by several of his contemporaries in the Great Lakes region (MacNeish 1952; Mason 1958, 1960, 1962; Quimby 1952, 1960; see Ellis and Deller 2000; Ellis et al. 1998; Jackson et al. 2000) and seemed to provide evidence of an antiquity for Paleoindian occupations there commensurate with the more famous sites in the West and High Plains (Sellards 1952; Wormington 1957).

Although it appeared from the limited data set with which he had to work that fluted point isolates often fell within the maximum margins of glacial lakes Vermont and Iroquois, as they were then understood, a fair number of fluted point isolates, in addition to the Reagen site, fell outside but near or immediately adjacent to Champlain Sea shorelines (Ritchie 1957:Figure 2). Unfortunately, the geological radiocarbon dates Ritchie referenced for both the Lake Vermont and Champlain Sea events were too recent to fit comfortably within the Paleoindian period as it is generally understood today, and as it was coming to be understood then. Instead of questioning the dates, however, Ritchie initially proposed a delayed and extended Paleoindian occupation in the Far Northeast. This theory was soon contested by other researchers (e.g., Mason 1960).

With the publication of *The Archaeology of New York State* in 1965, Ritchie revised his assertions somewhat. New radiocarbon dates and new corrections for older shell dates pushed back considerably the antiquity of the Champlain Sea, though only in a broad sense (Ritchie 1980). Although he still maintained that a credible connection existed between Champlain Sea margins and Paleoindian occupations in the region, discrepancies in the radiocarbon dates from the few reported Paleoindian sites in the Northeast and Maritimes at that time (Bull Brook and Debert) and the lack of resolution regarding the timing of the inception and drainage of the Champlain Sea forced Ritchie to propose a very broad range for the (Early) Paleoindian period in the region, circa 6,000–9,000 BC (Ritchie 1980:14–15; see Byers 1959; MacDonald 1985). Obviously, this was not particularly illuminating, even within a broad culture-historical schema.

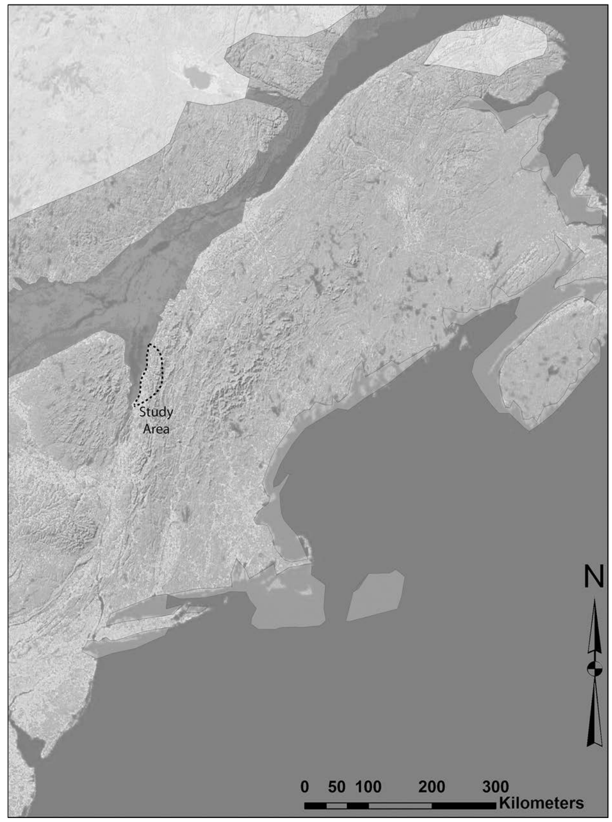
Ultimately, although Ritchie was one of the first to propose a direct connection between the Champlain Sea and Paleoindians, he did not develop these ideas much further. Indeed, having posited a connection, he nevertheless maintained the normative view of the time that Paleoindians were nearly exclusive terrestrial big-game hunters (e.g., Mason 1962; Quimby 1960; Sellards 1952; Willey 1966; Wormington 1957). Having failed to provide an adequate indirect dating mechanism for the Reagen site and others, he seems to have eventually abandoned the Champlain Sea as an avenue of inquiry.

Over the course of the fifteen years following Ritchie's (1965) book, interest in the connection between Paleoindians and the Champlain Sea waned. Loring revived the topic somewhat when he published an article in *Man and the Northeast* in 1980 titled "Paleo-Indian Hunters and the Champlain Sea: A Presumed Association" (Loring 1980; see also Snow 1980). Motivated by his exhaustive work documenting collections from Vermont avocational archaeologists, the article, in part, plotted several fluted point isolates with (variably reliable) provenience information over a map with the maximum margins of the Champlain Sea indicated. From the resulting synthesis, Loring, like Ritchie before him, promulgated the theory that there was a direct correlation between the margins of the Champlain Sea and Paleoindian groups.

As with Ritchie, however, the data set with which Loring worked consisted almost entirely of isolated fluted point spot finds. Moreover, the provenience information was collected secondhand, and often locations were approximate at best (Loring 1980; see Robinson 2008; Robinson and Crock 2008). Additionally, a significant number of

isolate locations fell within the margins of the Champlain Sea maximum. Finally, as with Ritchie, the approximate dates for the inception and drainage of the Champlain Sea at the time of Loring's writing did not agree with the generally accepted date ranges for Paleoindians in the region. At that time, however, the Champlain Sea dates were seen as being too old for Paleoindians, not too young, as was the case with Ritchie's proposal. After Loring's article, a direct connection between Paleoindians and the Champlain Sea was nearly always mentioned as a possibility in state publications and regional summaries (e.g., Haviland and Power 1994; Snow 1980), but because definitive data were still seen as lacking few explored the idea beyond this tacit acknowledgment.

Within the past decade, a relatively large amount of research has begun to rectify the formerly contradictory or disparate evidence regarding the late glacial lacustrine and marine geochronology of the region. Although not all issues have been resolved and the timing of events is still being refined, a synthesis of these data as they are now understood for the first time lends substantial scientific validity to the notion that Paleoindian occupations were coeval with the Champlain Sea for at least a portion of the date range to which researchers generally assign their tenure in the region (Bradley et al. 2008; Newby et al. 2005; Spiess et al. 1998).



10.1. Overview of the Far Northeast region and the Champlain Sea, ca. 11,800 cal BP (base map source: ESRI online 2011).

THE CHAMPLAIN SEA EVENT: GEOLOGICAL SUMMARY AND CONSIDERATIONS

At the end of the Pleistocene epoch, the Champlain Basin corresponded to the junction of two important late glacial lake outflow routes: the Hudson Valley to the south and the St. Lawrence Valley to the northeast (figure 10.1) (Rayburn et al. 2005). Specifically, the drainage of several glacial lakes (e.g., Lake Vermont and Lake Iroquois) and the various identified stages within their broader existence were routed first through the Hudson Valley and, after glacial retreat, through the St. Lawrence Valley to the Atlantic Ocean (Carlson et al. 2007; Parent and Occhietti 1999; Rayburn 2004; Rayburn et al. 2005; Rayburn et al. 2007; Theiler et al. 2007; Wright 2003). Space precludes a detailed summary of the inceptions and eventual drainages (via catastrophic flood) of these glacial lake events, but recent refined dating techniques by Rayburn et al. (2005), Rayburn et al. (2007), Ridge (2003, 2004), and Ridge et al. (1999), among others (e.g., Franzi et al. 2007; Occhietti et al. 2001; Wright 2003), suggest that although they appear to be more recent than earlier studies have indicated they nevertheless preceded sustained Paleoindian occupation in the region (Jackson et al. 2000).

The quick, successive drainage of these glacial lakes introduced an enormous amount of fresh water into the Atlantic Ocean (Marshall and Clarke 1999; Rayburn et al. 2005; Rayburn et al. 2007). Researchers have theorized for some time that the rapid or catastrophic drainage of major freshwater glacial lakes (e.g., as glacial Lake Agassiz) into the Atlantic Ocean could have disrupted the thermohaline ocean circulation and caused the onset of the Younger Dryas chronozone, circa 12,900 cal BP (Broecker et al. 1989; Clarke et al. 2001; see Stouffer et al. 2006), or other global cold periods (e.g., the intra-Allerød cold period or Preboreal Oscillation). Rayburn et al. (2005) and Rayburn et al. (2007) suggest that one freshwater trigger for the onset of

the Younger Dryas was the steady-state freshwater outflow through the Hudson Valley combined with the relatively rapid series of Lake Vermont/Lake Iroquois catastrophic flood events (possibly including Lake Agassiz). They calculate that the cumulative outflow through these outlets surpassed the benchmark levels calculated by Rahmstorf (1995, 2000, 2002) as the likely amount of fresh water required for the disruption of the Atlantic thermohaline current (see Cronin et al. 2008).

Whether or not the drainage of Lake Vermont or Lake Iroquois was the direct catalyst for the Younger Dryas, the demonstrated coincidence of these glacial lake drainages, the incursion of the Champlain Sea, and the onset of the Younger Dryas is extremely important for the timing of the entrance of the first humans into the region and for modeling the environmental conditions they faced and geological and hydrological entities that structured their lifeways (Cronin et al. 2008; Newby et al. 2005). Indeed, Newby et al. (2005) have convincingly demonstrated that the onset of the Younger Dryas and the initial Paleoindian occupations in the broader Northeast region were roughly synchronous. Whether the Younger Dryas fostered an environmental regime more amenable to Paleoindians (Newby et al. 2005), the Champlain Sea and former glacial lake margins served as travel corridors into the region (Dincauze and Jacobson 2001; Newby and Bradley 2007), or other factors stimulated these movements is still uncertain, however.

The incursion of the Champlain Sea was initiated as a result of the recession of glacial ice north of the Gulf of St. Lawrence. After the greater Lake Vermont flood pulse through this outlet (Wright 2003), the isostatically depressed land comprising much of the St. Lawrence lowland, the Champlain Basin, and portions of Ontario was inundated by North Atlantic marine waters (Barnett 1988; Ridge 2004; Rust 1988; Storck 1997). Like the earlier glacial lake events, dating the inception, tenure, and eventual drainage of the Champlain Sea has been quite problematic for regional researchers.

Early on, marine mollusk shells appeared to many to represent a reliable, intact, and relatively abundant source of carbon from which to derive radiocarbon dates. As time went on, however, it became increasingly clear that attempts to date these shell deposits often produced drastically different results, regularly varying from before 13,000 ^{14}C yr BP to after 9000 ^{14}C yr BP (Rayburn et al. 2006; Rayburn et al. 2007), with sometimes as much as a 10,000-year divergence. Moreover, no obvious correction seemed to be applicable to them. Results appeared to vary across the former breadth of the Champlain Sea, and date inversions were even reported within the same or similar stratigraphic sequences (Rayburn et al. 2006; Rayburn et al. 2007; Rodrigues 1988).

Researchers have recently recognized that the amount of “old” carbon dissolved in the marine waters of the Champlain Sea varied significantly across its breadth, throughout time, and also with depth below the former water surface in some areas (Hunt and Rathburn 1988; Richard and Occhietti 2005; Rodrigues 1988). Thus, mollusks acquiring carbon from the marine waters that surrounded them absorbed different amounts of “old” carbon depending on their geographic location and their depth below the water surface. This marine reservoir effect, coupled with other factors such as the differential uptake of carbon by different species, the carbon content of the underlying or surrounding bedrock, and even variable laboratory calibrations, compounded dating problems in some instances (Occhietti et al. 2001; Richard and Occhietti 2005). Researchers have thus realized that quite sophisticated marine reservoir corrections are needed to account properly for these discrepancies and that this precludes a blanket reservoir correction for the entire Champlain Sea, as had been previously employed by some researchers. Generating marine reservoir corrections for mollusk shells for all areas of the Champlain Sea, in all depths at all times, is seen by some as “an intractable task” (Richard and Occhietti 2005:357; see Dyke 2004).

Accordingly, researchers have begun to rely more heavily on dating techniques or methodologies that do not rely solely on aquatic mollusk shells or aquatic plant macrofossils, except as evidence of their skewed results relative to other dating techniques or to generate reliable corrections for certain areas within the sea (Anderson 1988; Cronin et al. 2008; Rayburn et al. 2005; Rayburn et al. 2007; Richard and Occhietti 2005; Ridge 2003; Ridge et al. 1999; Rodrigues 1988). These techniques include but are not limited to lithological, CHIRP (compressed high intensity radar pulse) sonar, paleomagnetic, stable isotopic, and micropaleontological analyses, in addition to the re-

juvenation and reapplication of Antevs's (1922, 1928) New England varve chronology and a firmer reliance on dates from terrestrial plant matter recovered from pond or Lake Champlain sediment cores or from now-elevated Champlain Sea/Lake Vermont shorelines. Importantly, but much more rarely, terrestrial faunal remains have been dated (e.g., Tremblay 2008). The generation of accurate calibrations for radiocarbon dates from this period has been a particularly important development toward the proper chronological placement of the Champlain Sea (and other late Pleistocene geological events). As Ridge et al. (1999:96) suggest, there are significant "disparities between . . . ^{14}C and calibrated ages resulting from the secular variation of atmospheric ^{14}C. Several compressions of the ^{14}C time scale occur from 12.4 to 10.7 ^{14}C ka as well as a prominent ^{14}C plateau at 12.6–12.4 14C ka. Recognition of ^{14}C variations in these time spans is critical to formulating an accurate ^{14}C chronology for glacial events in New Hampshire and Vermont" (see Anderson 2001; Curran 1996; Fiedel 1999; Levine 1990).

Various researchers, employing one or more of these techniques (e.g., Anderson 1988; Cronin et al. 2008; Rayburn et al. 2005; Rayburn et al. 2007; Richard and Occhietti 2005; Ridge 2003, 2004; Ridge et al. 1999; Rodrigues 1988), have all recently reported similar (albeit variably tentative) results, which, in part, conclude that the inception of the Champlain Sea was sometime around 13,000 cal BP (ca. 11,000 ^{14}C yr BP). This is a significant revision from estimates generated even a decade ago (e.g., Kirkland and Coates 1977; Loring 1980; Occhietti et al. 2001; Snow 1980; see Rayburn et al. 2007; Rodrigues 1988) and pushes the date forward by almost 1,000 years. Thus, as stated previously, this revised estimate roughly correlates with the estimated dates of the first human occupations in the broader Northeast region (ca. 12,900–12,800 cal BP; Bradley et al. 2008:126–130) as well as the onset of the Younger Dryas chronozone (Bradley et al. 2008; Newby and Bradley 2007; Newby et al. 2005; Spiess et al. 1998). Within the Champlain Basin itself, however, Paleoindians are not visible in the archaeological record until the Bull Brook/West Athens Hill subperiod, circa 12,700–12,200 cal BP (Bradley et al. 2008; Robinson et al. 2009; see Crock and Robinson, this volume).

The timing of the regression and eventual drainage of the Champlain Sea is also an extremely important factor for evaluating its importance to Paleoindians throughout the period. Unfortunately, these aspects of the Champlain Sea have been much less thoroughly explored by geologists to date. Although early researchers mapped what they believed were distinct regressive shorelines of the sea (e.g., Chapman 1937; Woodworth 1905), which were subsequently reified into discrete regressive stages, it is now generally believed that discrete stages of the Champlain Sea do not make geological sense. There is no identifiable mechanism (such as catastrophic drainage) through which they would have formed (Wright 2003). Rather, it is more likely that slow, continuous isostatic rebound would have eventually caused marine waters to drain and form a freshwater lake (Lake Champlain), such as exists today. The distinct "benches" mapped earlier in the century are more likely the result of erosion from large storm events, tidal action, or discontinuities in the rate of isostatic rebound in some areas (Rayburn 2004; Wright 2003; S. Wright, personal communication 2007; see Jennings et al. 2003). Stages of the Champlain Sea that do not correspond to sea levels, but rather to certain indexical resident mollusk species, have been utilized by some authors, however (Cronin et al. 2008; see Cronin 1977; Elson 1969; Guibault 1989, 1993; Hillaire-Marcel 1981).

An important publication by Cronin et al. (2008) has shed some light on the timing of the end of the Champlain Sea. Although not the primary focus of their study, Cronin et al. (2008:52) note that the earliest postmarine, lacustrine sediments in several cores date to approximately 9800–9700 cal BP and are also marked by the first appearance of thecamoebians (nonmarine testate protozoans) and *Cytherissa lacustris* (a freshwater ostracode). This date also accords well with others from the Montreal and St. Nicholas areas of Quebec for the end of the Champlain Sea (Elson 1988b; Occhietti et al. 2001). In the latter area, however, researchers recognize the presence of the freshwater Lampsilis Lake in the area at this time. The generally accepted date of the inception of this water body (ca. 10,600 cal BP) somewhat overlaps, and thus is somewhat at variance with, the end dates for the Champlain Sea reported by Cronin et al. (2008), at least at this point. It is likely that these variable end dates reflect the use of different indicators for the marine/lacustrine transition. In the preceding summary, I used a single criterion to define the end of the Champlain

Sea—an influx of marine water from the Atlantic (however minimal and diluted it may have been at the sea's conclusion), arrived at indirectly through reliance on the Cronin et al. (2008) core sediment analyses and the presence of the first freshwater organisms within them. Sea (or lake) levels or general productivity are not specifically considered as evidence for the transition. It is likely that additional research will better elucidate the timing and circumstances surrounding the conclusion of the sea.

Although very preliminary, the dates reported by Cronin et al. (2008) for the Champlain Basin suggest that the Champlain Sea was in existence for the vast majority or even the entire Paleoindian period (ca. 13,000–10,000 cal BP; Bradley et al. 2008). It is even possible that marine or brackish conditions extended into the beginnings of the Early Archaic period (depending at least partially on when one chooses to designate the Early Archaic period's beginning), though the sea receded more or less to modern Lake Champlain levels by its conclusion. Through a variety of processes, most notably including salinity changes (see Pintal, this volume), the biotic productivity of the sea may have fluctuated significantly over its tenure, though the details and implications of these changes are just beginning to be explored (Cronin et al. 2008; Rayburn et al. 2007).

ENVIRONMENTAL REGIMES AND RESOURCES DURING THE LATE PLEISTOCENE AND EARLY HOLOCENE IN THE CHAMPLAIN BASIN

Using palynological data derived from their cores of Champlain Sea sediments, Cronin et al. (2008) suggest that the tenure of the Champlain Sea roughly correlates to Anderson's (1988) pollen stratigraphic zones seven through five. Owing to the time-transgressive nature of glacial retreat and forest repopulation, Anderson's stratigraphic sequence, based largely on slightly more northern sediment cores from the Ottawa Valley, likely occurred earlier in the Champlain Basin (Cronin et al. 2008; see Anderson et al. 2007). Cronin et al. (2008) suggest that the beginning of Anderson's zone seven, or *Picea* (spruce) zone, likely correlates to the inundation of the Champlain Basin by the Champlain Sea (ca. 13,000 cal BP) and continues more or less for the duration of the Younger Dryas chronozone (Newby et al. 2005). Anderson (1988) suggests that the *Picea* zone is defined by an abundance of *Picea* (Newby et al. 2005) but also by relatively high percentages of *Abies* (fir), *Juniperus/Thuja* (juniper/arborvitae), and *Betula* (birch). Cronin et al.'s (2008) Melo-5 and 6 cores, which represent the earlier portion of the Champlain Sea sequence, also exhibit a general abundance of *Picea,* but also very high percentages of *Pinus* (pine) and the consistent presence of *Tsuga* (hemlock), *Abies, Betula,* and *Quercus* (oak). Herbaceous pollen is also present in low percentages. Cronin et al. (2008) date the *Picea* zone to approximately 12,900–11,000 cal BP in the Champlain Basin.

Anderson's (1988) zone six is referred to as the *Betula* pollen zone. As the name implies, this transitional zone is marked by an abundance of birch pollen. *Alnus* (alder) was also abundant in this zone (see Cronin et al. 2008). Cronin et al. (2008) did not document a specific correlate to this zone in their cores, but it may pertain as a transition to Anderson's (1988) zone five in the Champlain Basin.

Anderson's (1988) zone five is referred to as the *Pinus* pollen zone. He defined this zone on the basis of a distinct dominance of *Pinus,* as well as a spike in the incidence of *Abies*. The incidence of *Betula* and *Picea* declines from the beginning of the zone, while *Quercus* generally remains stable at approximately 5–10 percent of the analyzed samples. Notably, Anderson (1988) states that the overall incidence of pollen increases almost twofold between zone seven and zone five, suggesting the growth of an increasingly dense forest regime.

Cronin et al.'s (2008) Melo-1 core, which spans the latter portion of the tenure of the Champlain Sea, shows a similarly high preponderance of *Pinus* pollen (57 percent) and a drop in *Picea* (ca. 20 percent). *Quercus, Abies,* and *Betula* were also present in the stratigraphic sequence. Cronin et al. (2008) date zone 5 (*Pinus* zone) to approximately 11,000–9500 cal BP in the Champlain Basin. The end date also roughly correlates with the Champlain Sea/Lake Champlain transition. Other studies of glacially formed ponds in Vermont (Li 1996) and the adjoining region (Lord 2003) also generally conform to the sequence defined by Cronin et al. (2008). Parenthetically, although a mixed forest regime eventually came to dominate the Champlain Valley bottom in Vermont over the course of the Holocene, Siccama (1974) notes that the Green Mountains still exhibit

a distinct altitudinal break defined by a resident boreal forest regime above a relatively uniform elevation.

There is no doubt that plants were procured for food and medicine and for the construction of clothing, binding, mastic, containers, and so forth by Paleoindian peoples. Some even argue that the bottle gourd (*Lagenaria siceraria*) was brought to the New World as a domesticate (Erickson et al. 2005). Unfortunately, evidence of plant use by Paleoindians is extremely rare in the Northeast (Spiess et al. 1995). Moreover, the incidence, breadth, and density of lower-order plant species are more difficult to quantify through pollen core analyses, and thus it is at this point not feasible to assess the degree to which plant procurement would have factored into the movement, settlement, or subsistence practices of Paleoindian groups in the Champlain Basin or elsewhere in the Northeast.

Like floral remains, extremely poor preservation precludes the recovery of late Pleistocene and early Holocene terrestrial faunal remains in the region, except in rare cases. Indeed, no faunal remains have been recovered from any Paleoindian archaeological site in the state of Vermont. Looking more broadly throughout the Far Northeast, caribou bones have been identified from several archaeological sites as have beaver, hare, and arctic fox (Cannon and Meltzer 2004; Cleland 1965; Curran 1994; Funk et al. 1970; Meltzer 1988; Robinson et al. 2009; Spiess et al. 1984–1985; Spiess et al. 1998; Storck and Spiess 1994). I discuss the importance of caribou to Paleoindian groups through time later in this chapter.

Moose (*Alces alces*) and deer (*Odocoileus virginianus*) were locally available and likely represented important food and raw material resources. They may have even rivaled caribou in importance during the latter portion of the Paleoindian period or during specific seasons (Kuehn 1998; Newby et al. 2005; Petersen et al. 2000). Small and medium-size mammals were also likely important resources for food, fur, and osseous material from which to fashion tools. Again, however, almost no evidence of their predation, consumption, or use has yet been identified in the Northeast.

There have been very few identifications of late Pleistocene megafaunal remains in Vermont. Perhaps the most famous is the Mount Holly mammoth, discovered in the town of Mount Holly in the midst of the Green Mountains in 1849 during the construction of a railroad line (Agassiz 1850; Thompson 1850). Although the Jackson-Gore Paleoindian site is located within the same valley corridor through the Green Mountains as the Mount Holly mammoth (Crock and Robinson 2009; Robinson and Crock 2007; and see Crock and Robinson, this volume), there is no evidence of a direct correlation. Indeed, recent work by G. Robinson et al. (2005) and Gill et al. (2009) suggest that, although not fully extinct, numerous genera of megafauna experienced population collapse prior to regional glacial retreat (see Cannon and Meltzer 2004; Grayson and Meltzer 2002).

Dincauze and Jacobsen (2001) suggest that duck and other waterfowl flyways would also have been important attractions for people and may perhaps partially account for Great Lakes and Champlain Sea site locations. Like most other potentially procurable faunal species, however, there is no direct evidence to support this as yet.

By the Ste. Anne/Varney "phase" of the Late Paleoindian period, there is a demonstrable shift in site preference to water bodies, including riverine, lacustrine, and large wetland areas (Jones 2003; Nicholas 1987, 1988, 1998; Petersen 2004; Petersen et al. 2000; Robinson and Crock 2006; Spiess 1992; Spiess et al. 1983; Pintal, this volume). Indeed, several of the few Ste. Anne/Varney phase sites known in the region were identified at the basal depths of stratified, alluvial sequences (e.g., Bolian 1980; Doyle et al. 1985; Petersen 1991; Sanger et al. 1992; Sanger et al. 2003; Thomas 1992; see Robinson and Crock 2006; Crock and Robinson, this volume). This differs markedly from the typical site locations of previous periods, which are almost never located on river alluvium (Spiess 2002; Spiess et al. 1983; Spiess et al. 1998). Groups producing Ste. Anne/Varney phase points also began to add to their toolkit implements that may have been used in fish processing, such as tabular knives made from metasedimentary materials (Robinson and Crock 2006), though as for most other faunal material there are no reported fish remains from any site in the region, at least as far as I am aware. Certainly, however, by the subsequent Early Archaic period fish was being actively procured, at least seasonally. Their procurement and use is attested by the recovery of fish bone from several sites (e.g., Petersen 1991; Spiess 1992; Thomas and Robinson 1980).

Also beginning with the Ste. Anne/Varney phase, evi-

dence along the Gaspé Peninsula in Quebec tentatively suggests that marine mammals were actively hunted (Benmouyal 1987; Burke 2002; Chalifoux 1999; Chapdelaine 1994; Dumais 2000; Dumais and Rousseau 2002; Occhietti et al. 2001; see Pintal, this volume), or at least that the maritime-centered locations provided productive resource bases for these groups. This evidence primarily consists of site locations and the hydrological and environmental regimes characterizing the area, which conceivably would have been amenable to marine mammals and their procurement. The history of the area as a place of marine mammal hunting by subsequent Native American groups is also illustrative. Blood residue analysis on tools from the La Martre site identified *Pinnipedia* (sea lion, seal, walrus) (Chalifoux 1999; see Harington 1977), and similar results were also reported from the Rimouski site (Chapdelaine 1994:Annexe 2), but many researchers have serious doubts about the efficacy and accuracy of blood residue studies, particularly from sites of Paleoindian antiquity.

The tentative evidence for some form of marine resource procurement by regional human groups by the Late Paleoindian period is potentially important as an indication of the procurement strategies of later (and perhaps earlier) Paleoindian groups in the Champlain Basin (Robinson and Crock 2006). Indeed, as stated previously, it was heretofore generally assumed that Paleoindian groups relied heavily or solely on terrestrial fauna, both because of the western analogues on which many of the formative theories regarding the Paleoindian period in the Northeast were predicated (Cannon and Meltzer 2004) and because some researchers assumed that rapid sea level regression and subsequent transgression would have precluded the development of barrier beaches, tidal flats, and salt marshes critical to a coastal ecosystem, at least in the Gulf of Maine (Oldale 1985).

The Champlain Sea, however, appears not to have undergone these rapid shoreline changes. After the initial inundation of the Champlain Basin, a steady period of isostatic rebound appears to have ensued, though as stated previously isostatic processes continue to be incompletely understood. While the Champlain Sea was in existence, these relatively stable conditions apparently fostered an abundance of aquatic life including along the sea's southern arm in the Champlain Basin. The relative productivity of the Champlain Sea environment is still being debated by researchers, however (D. Franzi, personal communication, 2009; J. Rayburn, personal communication, 2009).

Throughout much of the Champlain Sea's existence, it appears to have exhibited a stratified water column. At significant depth, cold, subarctic, high salinity marine conditions pertained, which were constantly fed by deep water currents from the Atlantic Ocean (Rodrigues 1988). At shallow depth, relatively low salinity conditions pertained, which were regulated by the steady inflow of glacial meltwater and pronounced runoff (Rodrigues 1988; see Hunt and Rathburn 1988). Salinity fluctuations have recently been noted, however, beyond these relatively stable conditions (Cronin et al. 2008; see Hunt and Rathburn 1988), which may be indicative of flood pulses from glacial lake drainage farther west (Cronin et al. 2008; Rayburn et al. 2007).

These conditions generally allowed a variety of vertebrate and invertebrate fauna to inhabit the Champlain Sea (Harington 1977, 1988; Loring 1980; Perkins 1908; Occhietti et al. 2001; Rodrigues 1988; Thompson 1850). For instance, the fossil remains of white whale, narwhal, finback whale, bowhead whale, harbor porpoise, several species of unidentified large whale, walrus, ringed seal, harp seal, bearded seal, and hooded seal have all been identified in Champlain Sea sediments. Numerous fish species have also been identified in Champlain Sea deposits, as well as several shore bird species (Harington 1977, 1988; McAllister et al. 1988).

The environment also appears to have been highly conducive to invertebrate mollusk populations, though hydrological conditions apparently made the Champlain Sea more attractive to particular species throughout time. Specifically, the earlier portion of the Champlain Sea is defined by a preponderance of *Hiatella arctica,* a subarctic, moderate to high salinity species (Cronin 1977, 1981; Harington 1977; Rodrigues 1988). Later, when maximum temperatures increased during the summer months and average salinity was reduced, *Mya arenaria* (soft-shelled clam) became the predominant species (Cronin 1981). These invertebrate community changes seem to correspond relatively closely to the pollen zone transitions as well, and to the emergence of a relatively thick boreal forest (Rodrigues 1988). Numerous other species of mollusk have also been identified.

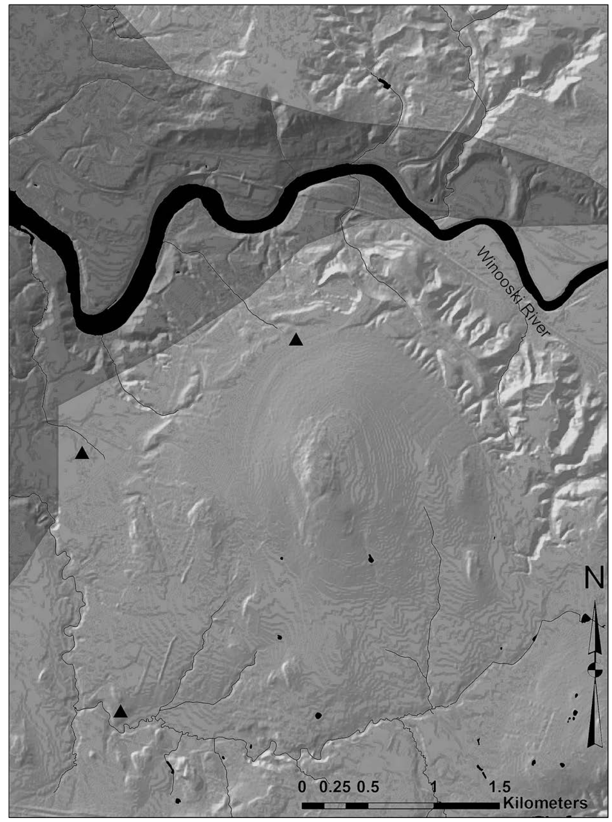
In summary, although much work remains to be done,

it is now reasonably clear that the Champlain Sea was in existence throughout most or all of the Paleoindian period and that it contained exploitable marine resources, or at least resources to which other locally resident terrestrial and avian faunal species would have been attracted.

PALEOINDIANS AND THE CHAMPLAIN SEA

To better evaluate the possibility that Paleoindians were utilizing and perhaps focusing on landforms adjacent to the Champlain Sea, I conducted a survey of documented Paleoindian sites in Vermont and plotted their locations relative to relict Champlain Sea margins. This project was directly inspired by Loring (1980), who conducted similar research as part of his assiduous Vermont collector documentation efforts. I noted the shortcomings of Loring's study previously. Additionally, as Loring himself suggested, the correlation could probably be better demonstrated if chronologies of Paleoindian projectile points were developed for the region. Indeed, my spatial and diachronic survey was made possible only recently through the development by Bradley et al. (2008; see Newby et al. 2005) of a Paleoindian projectile point subtaxonomy for the Far Northeast.

My survey relied on a revised model of the Champlain Sea shoreline created with the ESRI ArcMap 9.2 Geographic Information Systems (GIS) program. Elevation data layers were incorporated with a recently completed surficial geological map of the area to better establish the extent of the shoreline of the Champlain Sea at its maximum (Vermont Geological Survey/Vermont Agency of Natural Resources 2008; see Doll 1970; Springston and DeSimone 2007; downloaded from the Vermont Center for Geographic Information [VCGI] in 2009). As Loring (1980) and others have noted, the maximum extent of the Champlain Sea is the only margin that can be adequately mapped because of the relatively pronounced shoreline features established during its initial inundation. Because isostatic rebound resulted in a north-south tilted water plane (i.e., perpendicular to isobase), an exact elevation for the maximum extent of the Champlain Sea cannot be given in meters amsl across the Champlain Basin. For instance, Chapman's (1937) strandline correlations for his Upper Marine stage (Champlain Sea Maximum) along the eastern Champlain Valley document an approximate 300 ft gradient between Whitehall, New York, at the southern end of what is today Lake Champlain and St. Albans, Vermont (Rayburn 2004). Likewise, calculating absolute sea depth for any area at any given point in time is similarly problematic. For some point of reference, however, in the Williston, Vermont/Winooski River area (recently mapped by Springston and DeSimone [2007]), the maximum extent of the Champlain Sea measures about 107 m (350 ft) amsl today (figure 10.2). Research since Loring's survey has demonstrated that lower stages of the Champlain Sea are likely no longer valid concepts, as noted previously (Wright 2003).

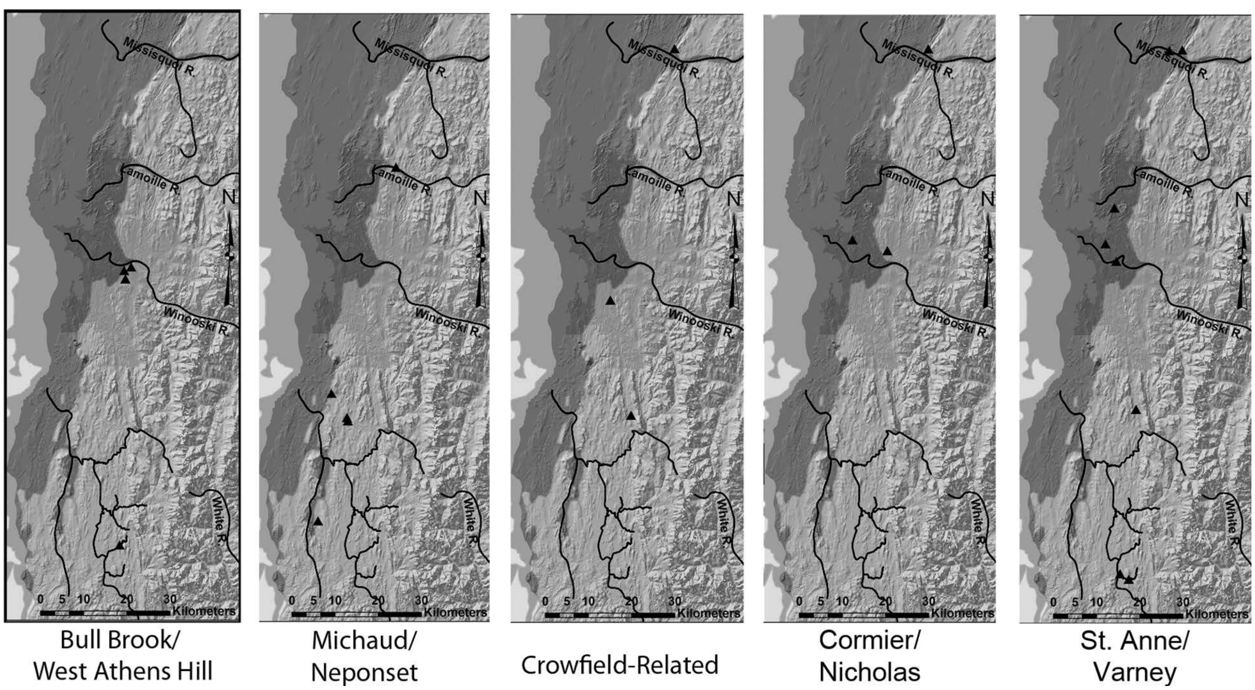


10.2. Close-up view of Bull Brook/West Athens Hill Paleoindian sites in relation to the Champlain Sea maximum/Winooski River confluence (estuary). The summit of the prominent hill depicted in the figure is at 700 ft amsl. Sites listed from north to south: Bishop site (VT-CH-818); Reynolds site (VT-CH-9210); Mahan site (VT-CH-197). Underlying LIDAR and 10 ft contour elevation layers downloaded for use in ESRI ArcMap 9.2 from the Vermont Center for Geographic Information in 2009.

The maximum extent of the sea was traced using both surficial geological maps and elevational limits, specifically following mapped deposits of marine sand, marine clay,

and related marine surficial deposits (Rayburn 2004; Rayburn et al. 2005; Rayburn et al. 2007). Elevational data were used sparingly, however. In areas corresponding to the southern portions of the Champlain Sea (where mapped marine surficial deposits are sparse), other researchers' contours, surveys, and maps were used to "fill in the gaps" (e.g., Chapman 1937; Loring 1980; Rayburn 2004; Stewart and MacClintock 1969; Wagner 1972). In addition, I was advised by John Rayburn (personal communication, 2009) that below an east-west line roughly corresponding to the Crown Point, New York/Chimney Point, Addison, Vermont area, isostatic rebound rates and patterns become particularly confusing and are incompletely understood at this point. Consequently, mapped maximum Champlain Sea margins below this line may or may not be equivalent to the maximum margins farther north. Readers are therefore advised to view the southern portion of the Champlain Sea margins depicted here (and elsewhere) as particular approximations.

Though much of the Champlain Sea maximum as rendered in this analysis closely mirrors the margins depicted in other researchers' maps, the extent to which the sea invaded the current Winooski and Lamoille river valleys appears to have been underestimated previously. Specifically, significant mapped deposits of marine sand or marine clay trend a fair distance inland from the general Champlain Sea shoreline, particularly in the Lamoille River area. Thus, although it is possible that the Champlain Sea extended even farther inland along the current river valleys than the mapped deposits suggest, the deposits minimally attest that the Champlain Sea overlaid those areas (figure 10.3) (Springston and DeSimone 2007). For the Missisquoi River area, it conversely appears that many previous maps overestimate the extent to which marine waters invaded the current river valley. The limits indicated here still depict the Champlain Sea trending fairly significantly eastward from the general Champlain Sea shoreline, but the mapped marine sand and clay deposits do not suggest that marine waters extended as far north as Lake Carmi near the Quebec border or as far east as the Green Mountain foothills.



10.3. Paleoindian sites in relation to the Champlain Sea maximum. Sites listed from north to south. Bull Brook/West Athens Hill: Bishop site (VT-CH-818); Reynolds site (VT-CH-9210); Mahan site (VT-CH-197); Leicester Flats site (VT-AD-127). Michaud/Neponset: Fairfax Sandblows site (VT-FR-64); Hinsdale site (VT-AD-195); site VT-AD-82; site VT-AD-167; site VT-AD-679. Crowfield-related: Reagen site (VT-FR-3); Auclair site (VT-CH-3); Bristol Pond (VT-AD-11). Cormier/Nicholas: Reagen site (VT-FR-3); Paquette II site (VT-CH-190); site VT-CH-230, locus 3. Ste. Anne/Varney: Reagen site (VT-FR-3); Bessette II site (VT-FR-140); Gonyeau collection/Arbor Gardens (VT-CH-885); Mazza site (VT-CH-9179); Winooski Development site (VT-CH-900); Bristol Pond outlet (VT-AD-160); Otter Creek #2 (VT-RU-13); Arnold Brook site (VT-AD-572).

Rather, these levels were likely achieved only during the previous late glacial Lake Vermont stages.

There are twenty-two Paleoindian sites in the diachronic site distribution survey presented here. Four of the sites—the "Fairfax Sandblows" site (VT-FR-64), the Reagen site (VT-FR-3), the Hindsdale site (VT-AD-195), and an isolated Michaud/Neponset point collected by Earl Bessette of New Haven (VT-AD-82; Loring 1980:Figure 10.2)—were mapped by Loring and used in his analysis. In the case of the "Fairfax Sandblows" site and the Bessette fluted point from site VT-AD-82, however, I replotted their locations using newly uncovered archival data in the former case (Robinson and Crock 2008) and a GPS-documented location provided by Bessette in the latter. Earl Bessette also possessed another portion of a Michaud/Neponset projectile point, and I also GPS-documented the recovery location of this point. The Bessette fluted points are considered separate sites for the purposes of this analysis, since they were found more than half a kilometer apart (see Crock and Robinson, this volume). The other eighteen sites were discovered after Loring's survey, many during professional archaeological surveys.

To limit error in either projectile point type attributions or location attributions for this survey, I relied only on sites that were professionally excavated or reported by archaeologists, or where I trusted the reporters and could photograph, measure, and examine the artifacts. All of these sites are summarized in the Crock and Robinson chapter of this volume. Sites that were reported secondhand through collectors or even sites listed in the Vermont Archaeological Inventory (VAI) were not included unless I could confirm the site's location and artifact attributions through direct evidence or in a technical or academic report or article.

It should be noted that the criteria listed above were established prior to the formal aggregation and plotting of sites. I did not "pick and choose" sites in a preferential manner. Thus, although there are certainly biases inherent in the data set, notably including the increased amount of avocational collecting and CRM surveys conducted in areas where farming or development is prominent, I attempted to avoid prejudicing the data set at the analytical level. Sites were plotted chronologically on the five maps in figure 10.3 based on the types explicated by Bradley et al. (2008).

The first map depicts sites attributable to the Bull Brook/West Athens Hill portion of the Early Paleoindian period, which thus far represents the earliest set of sites in the Champlain Basin (see below). Sites containing King's Road/Whipple or Vail/Debert points have not yet been conclusively identified in the state (Bradley et al. 2008; Crock and Robinson, this volume). There is also no Agate Basin–related category included in this survey, since I have reservations about that subtaxonomic category (Robinson 2008, 2009), and no points strictly corresponding to the parameters defined by Bradley et al. (2008) have been identified within the Champlain Basin in any case.

Although the cumulative site or individual type site data sets are not large, interesting patterns nevertheless emerge with regard to their relationship to the Champlain Sea. During the earliest subperiod reliably represented in the Champlain Basin (Bull Brook/West Athens Hill), there is a notable concentration of three sites around the area where the Winooski River emptied into the Champlain Sea.

During the subsequent subperiod, defined by the production of Michaud/Neponset projectile points, sites appear to be more widely distributed. The uplands near Little Otter Creek and Bristol pond appear to become attractive locales, particularly if one takes into account several of Loring's (1980) Michaud/Neponset point locations. Site VT-OL-57 and the Jackson-Gore site (not depicted in figure 10.3) may also be two sites that demonstrate east-west travel into or out of the basin (Robinson and Crock 2007; Crock and Robinson 2009; see Crock and Robinson, this volume). Perhaps most notable, VT-FR-64, the "Fairfax Sandblows" site, which apparently represents a fairly large Michaud/Neponset occupation (Robinson and Crock 2008), plots near the area where the Lamoille River flowed into the Champlain Sea, depending on the effects of isostatic rebound and sea regression during that time and the location information, which is approximate.

By the subsequent Crowfield-related subperiod, the Reagen site begins to be occupied. It is likely that it was located somewhere near the Champlain Sea during this period, although the lack of dates for Crowfield subperiod sites and the vagaries surrounding the effects of isostatic rebound make speculations about its precise location relative to the sea unwise at this point. The other two sites tentatively attributed to the Crowfield-related type were recovered from the Auclair site (VT-CH-3) on Shelburne

Pond (Petersen et al. 1985) and Bristol Pond (VT-AD-11). The former represents the only Paleoindian projectile point yet recovered from the Shelburne Pond area, but Bristol Pond contains abundant evidence of Paleoindian occupations, apparently spanning the majority of the broader Paleoindian period (Loring 1980; Crock and Robinson, this volume). The pond's presumed resource abundance, immediate proximity to fine-grained Cheshire quartzite outcrops, and position near a natural corridor through the Green Mountains likely made this glacially formed pond particularly attractive.

Prior to the Cormier/Nicholas subperiod, none of the sites included in this data set significantly encroach on the maximum limits of the Champlain Sea. Beginning during the Cormier/Nicholas subperiod, however, this changes rather dramatically. The Paquette II site (VT-CH-190) plots quite close to the current Lake Champlain shoreline. Inasmuch as it contains a diagnostic Cormier/Nicholas projectile point and was discovered and documented by the University of Vermont Consulting Archaeology Program during a formal CRM survey, its attribution and position appear to be accurate (see Crock and Robinson, this volume).

During the final portion of the Late Paleoindian period, the Champlain Sea appears to have receded well west of its maximum extent, since several Ste. Anne/Varney sites plot close to the current Lake Champlain shoreline, excluding the major river deltas. Along the Missisquoi River, the Bessette II site (VT-FR-140), which contains a probable late or transitional Paleoindian component (Thomas 1992; Thomas et al. 1996; Crock and Robinson, this volume), is located a significant distance to the west of the Reagen site, suggesting that Reagen was no longer in the immediate or even general proximity of the Champlain Sea by that time. Again, some caution must be exercised because the effects of isostatic rebound have not been adequately quantified locally. The Champlain Sea was likely still in existence, though marine waters likely receded to near the current Lake Champlain shoreline by that time.

Although the data set is small, and much more work needs to be done to better qualify the findings presented here, this diachronic distribution survey demonstrates what appears to be a clear correlation between Paleoindian sites and the Champlain Sea. First, there are no obvious anomalies plotted, such as a site significantly west of the Champlain Sea maximum during a period when that would not be expected. More interesting, revised mapping of the inundation of the major river valleys along the eastern edge of the Champlain Basin, coupled with new or better plotting of sites, appears to demonstrate a correlation between sites and features that may have been estuaries, or places where rivers met the Champlain Sea.

As noted previously, the Mahan site (VT-CH-197), and two other Bull Brook/West Athens Hill sites (see figure 10.2), are located near the maximum marine inundation of the Winooski River valley (Springston and DeSimone 2007; see Crock and Robinson, this volume). During that time, it appears that the Winooski River flowed from the east and emptied into the sea roughly at that point. Thus, it is logical to assume that estuarine conditions pertained in the general area for some time, seemingly including the Bull Brook/West Athens Hill subperiod. Prior to the recognition of Mahan's proximity to the Champlain Sea, its location on a small, rocky knoll within largely undifferentiated terrain seemed somewhat anomalous. Now, however, its slightly raised position above low-lying coastal/estuarine areas would likely have made it an extremely advantageous location. Mahan's presumed large size likewise suggests that this area was not an ephemeral occupation or hunting camp but rather hosted a number of individuals for a significant period of time.

Farther north, the location of the "Fairfax Sandblows" site (VT-FR-64), which is attributable to the subsequent Michaud/Neponset Paeloindian subperiod, was recently replotted based on archival information (Robinson and Crock 2008). Although the site location is still approximate, it too plots somewhere close to a position where the Lamoille River emptied into the Champlain Sea. At this point, however, it is not clear when exactly this occurred. Nevertheless, estuarine conditions likely pertained somewhere in the general area during the Michaud/Neponset subperiod.

Finally, the Reagen site (VT-FR-3) is also located at or near where the Missisquoi River emptied into the Champlain Sea. Cumulatively, the location of these sites suggests not only that the Champlain Sea provided a barrier beyond which it was impossible to occupy (through certainly not to traverse) but also that it provided locales or resources

that were actively exploited by Paleoindian groups. Indeed, the biotic productivity of estuaries is widely known. They often contain abundant fish, sea mammals, mollusks, and other marine life in addition to being a notable attraction for birds and terrestrial mammals. The location of three of the biggest Paleoindian sites yet discovered in Vermont in immediate or general proximity to these environmental features is likely no coincidence and suggests that some, many, or all of these resources were indeed being exploited by Paleoindian groups.

Moreover, although extremely tentative at this point, there does also appear to be a time-transgressive quality to these site locations. Specifically, the oldest sites are located along the southern Winooski River estuary-like feature, and the youngest is located near the Missisquoi River estuary-like feature. Although only conjecture at this point, it might be that over time the productivity of the southern, Winooski River/Champlain Sea area decreased because of the effects of isostatic rebound. When that occurred, favored occupation locations shifted farther north to the next estuary system. Many more site data are needed to confirm these speculations. Nevertheless, the distribution survey presented here at least provides a model of likely locations where additional testing should be conducted.

As noted previously, Oldale (1985) and others have suggested that the environmental conditions of many areas along the Atlantic coast would not have been conducive to abundant marine life during the late Pleistocene and early Holocene because of sea level changes and the pronounced environmental dynamism in those areas. This dynamism may have precluded the formation of salt marshes, tidal flats, and other biotically rich environmental features. After the catastrophic inception of the Champlain Sea, however, the Champlain Basin area appears not to have undergone these dynamic fluctuations and, rather, appears to have been relatively stable apart from the slow and steady effects of isostatic rebound. Indeed, the identification of ostracode, mollusk, sea mammal, and fish remains in addition to terrestrial mammal and bird species attests to the relative productivity of the Champlain Sea. It should be noted, however, that if the drainage of one or several glacial lakes farther west proves to have been routed through the Champlain Basin, the sudden sea level changes and salinity decreases may have had a profound effect on the local environment for an unknown duration (Cronin et al. 2008; Rayburn et al. 2007).

Thus, if Paleoindian groups were exploiting marine resources, this exploitation would just as likely, or even more likely, have occurred within the Champlain Basin as on the Atlantic coast. Moreover, whether exploitation of marine resources occurred in the Champlain Basin, along the Atlantic coast, or at both places on a seasonal or some other periodic basis, because of the inundation of the Atlantic coast area by rising sea waters the only evidence of it in the region will be identified in the Champlain Basin or in adjacent regions of Quebec, at least in the short to medium term.

DISCUSSION

Where once it was assumed that the first resident populations in the Champlain Basin and elsewhere in the Northeast faced a resource-depauperate, tundra-like environment, the environmental summary presented here suggests that the Champlain Basin was likely more amenable to all but the earliest human groups (assuming that Paleoindians arrived at the beginning of the taxonomic sequence defined by Bradley et al. [2008], which has yet to be demonstrated). Indeed, important palynological syntheses suggest that a spruce/pine parkland/boreal forest ecozone probably pertained for much of the greater Paleoindian period, and that mixed forest conditions may have even emerged in some areas during the Late Paleoindian period (Anderson 1988; Anderson et al. 2007; Cronin et al. 2008; Li 1996; Muller and Richard 2001; Newby et al. 2005; see Custer and Stewart 1990; Davis and Jacobson 1985). Of course, in many areas within the Far Northeast, such as southern Quebec, post-tundra tree colonization was heterogeneous and "patchy" (Muller and Richard 2001).

More generally, the existence of the Champlain Sea has implications for the normative view of Paleoindians in the region as peripatetic hunters (Beardsley et al. 1956; Loring 1997). The environmental regime, presence of the Champlain Sea, geography, topography, and other related factors may have necessitated a more seasonally regimented subsistence strategy than many have heretofore articulated (but see Curran and Dincauze 1977; Dincauze 1988; Dincauze and Jacobson 2001; Meltzer 1988; Newby and Bradley

2007; Wright 1989). Indeed, the Champlain Sea potentially provided an important resource base to these groups and likely structured their movements and lifeways to a great extent. These strategies assuredly changed over time as well. With few exceptions (Crock and Robinson 2009; Curran and Grimes 1989; Dincauze and Jacobson 2001; Newby and Bradley 2007; Robinson and Crock 2006, 2007), however, most research has largely neglected the Champlain Sea in subsistence models, movement trajectories, optimal foraging quantifications, or other related schema. This notable lacuna suggests that there needs to be a reworking of all of these models, and that many assumptions about Paleoindians in the Northeast generally may need to be reassessed.

Over the previous decades, models of regional Paleoindian subsistence movements, "rounds," or ranges have been proposed (see Jarvenpa and Brumbach 1983). These movements have continued to resist elucidation, however, except in the broadest terms (Burke 2006b; Curran and Grimes 1989; Deller 1989; Ellis 1989; Goodyear 1989; Spiess and Wilson 1989; Spiess et al. 1998). I suggest that in part this is a reflection of a disjuncture between the normative assumptions of northeastern Paleoindian lifeways and the data sets employed in order to demonstrate them (see Meltzer 1989). Although models of general "seminomadism" or "restricted wandering" (Beardsley et al. 1956) have been overtly disavowed by most as structures on which to base Paleoindian lifeways (Storck and von Bitter 1989), some of the underlying assumptions of or around those early models continue to influence basic conceptions of Paleoindian movement and settlement in the Northeast. In perhaps the most fundamental example, it is still generally assumed that caribou were integral to the subsistence strategies of Paleoindians in the Northeast, seemingly irrespective of season. The recovery of caribou faunal remains at a small number of sites attests to their importance in a general sense (Spiess et al. 1984–85, 1998). In many cases, however, caribou procurement is often an explicit or implicit explanation for everything from lithic procurement patterns to site location preferences. Uncritical assumptions regarding caribou hunting and processing further compound and accentuate these conceptions in some cases (Jarvenpa and Brumbach 2009; Loring 1997; Spiess 1979).

A detailed assessment of the potential for predictable caribou herd aggregation and dispersal cycles in the region during the late Pleistocene and earliest Holocene is thus important, because it is with Paleoindians' presumed reliance on caribou that so many other aspects of regional Paleoindian culture have often been intertwined. An assessment of this kind has not yet been adequately conducted, however (Spiess 1979). This is at least partially because contemporary caribou behavior is as yet incompletely understood, because one cannot assume that late Pleistocene caribou populations were equivalent to modern-day subspecies, and because a proper assessment is predicated to a large degree on a fairly fine grained understanding of the environment and its dynamism during the Paleoindian period (Spiess 1979). Though an assessment of this sort is far beyond the scope of this chapter, I note some potentially salient factors regarding caribou behavior, more to illustrate the problem's complexity than to generate potential answers (at this point) .

Caribou behavior differs both geographically and environmentally within regions (e.g., as expressed through subspecies designations). For example, there are demonstrated differences between the aggregation strategies of Eurasian and North American caribou and also between those of *Rangifer tarandus groenlandicus* (North American plains/tundra caribou) and *R. tarandus caribou* (woodland caribou) in the North American subarctic and arctic (Skogland 1980; Spiess 1979:34–35). Nevertheless, in most cases, when otherwise not restricted, caribou forage primarily on lichen (out of necessity) during the winter months and on vascular plants in the summer (Johnson et al. 2001; Klein 1982; Skogland 1980; Spiess 1979). Although preferences for certain food sources have been noted within both woodland and tundra caribou populations, and numerous factors are apparently involved in "patch" selection (snow depth and hardness in winter, predator susceptibility, insect exposure, and interspecies competition, among other factors), caribou seem primarily to gravitate to areas with the highest available phytomass density during the summer months (Skogland 1980). It is a conspicuous feature of caribou that they travel to these preferred areas along learned routes of access (Loring 1997; Skogland 1980; Spiess 1979). Nevertheless, these routes are often utilized only as long as the phyotmass at their destination can support them. Winter strategies, conversely, appear to be quite variable both

within and between subspecies when viewed at multiple scales (Johnson et al. 2001).

With regard to the Paleoindian period, it is difficult to know which areas would have been preferable for caribou herds at any given point in time, how large these aggregations would have been, and for how long these areas would have remained attractive, owing to the demonstrated regional environmental dynamism at the end of the Pleistocene and the beginning of the Holocene. Pelletier and Robinson (2005) and Robinson et al. (2009) have made a compelling case for a place of caribou aggregation at Jeffreys Ledge, now submerged off the coast of Massachusetts, during the period when the Bull Brook site was occupied. Similarly, the Vail site seems to represent at least in part some form of organized hunting event (Gramly 1982). In general, however, Paleoindian site examinations have focused more on the advantages the site location offered to hunters than to caribou (but see Newby et al. 2005).

Although the environmental conditions during the late Pleistocene and earliest Holocene have no exact analogue (Newby et al. 2005; Overpeck et al. 1985; Williams et al. 2001), it can at least be assumed that the area broadly resembled subarctic boreal forest/arctic parkland tundra (assuming both a diachronic and south-north gradient). Newby et al. (2005) have argued for the presence of an ecotone dividing northern Maine and the Maritimes (open tundra conditions) and areas to the south (open woodland to closed boreal forest) during most or all of the Younger Dryas chronozone. The effects of the Champlain Sea on northern vegetation and caribou movements were not quantified in that analysis, however (Muller and Richard 2001). In any case, there are a couple of important differences between the environmental conditions during the late Pleistocene in the Northeast and the modern subarctic that have implications for modeling caribou behavior.

First, Skogland (1980:95) notes that "plant growth during the 24 h diurnal cycle of light in the arctic and partially in the alpine location (60° N) is rapid in prostrate chamaephytes and hemicryptophytes which constitute the major part of the vegetation growing in the microenvironment near ground surface where daytime temperatures far exceed ambient temperatures when the ground is bared of snow or water" (see Bliss 1962; Spiess 1979). Thus, the 24-hour diurnal cycle in the arctic during a portion of the summer months stimulates the near simultaneous growth of a large amount of phytomass, which in turn enables large aggregations (herds) of caribou to move into the area annually and occupy it without undue competition, resource depletion, or search times. Limited food search time is particularly important to lactating females, to ensure success of the offspring (Skogland 1980:95).

No matter how similar or different the environment was at the end of the Pleistocene, available light was not radically different than it is today, at least in terms of number of hours in a 24-hour cycle (insolation is another important factor, but is not quantified here [McWeeney and Kellogg 2001]). Thus, when attempting to calculate potential herd sizes resident in the region during the Paleoindian period, it is important to recognize that summertime phytomass bases were likely smaller and "patchy" in a relative sense. The now submerged Atlantic coastlines and the now-raised Champlain Sea coastlines may have been important bases for this phytomass, but in the case of the late Pleistocene Atlantic coast in the Gulf of Maine its demonstrated dynamism may have inhibited its large-scale development or at least made productivity variable (Kelley et al. 1992; Oldale 1985; Spiess et al. 1995).

Two other potentially important factors are ice and wind in the amelioration of biting insects during the summer months. Although subsistence bases appear to be the foremost concern for caribou during the summer, areas where insects are kept at bay by ice or wind are also attractive (Farnell et al. 2004; Hare et al. 2004; Jackson et al. 2000; Spiess 1979; see Robinson et al. 2009). Remnant glacial ice in Maine or Quebec (Robinson et al. 2009), or the Champlain Sea or Atlantic coasts along two edges of the "cul de sac" (sensu Newby and Bradley 2007) of the late Pleistocene Far Northeast, may also have been attractive for this reason. Although only illustrative, Tremblay (2008) reports the recovery of a caribou antler from a lower Champlain Sea strandline on the north side of Covey Hill in Quebec, dated to 10,000 ± 95 ^{14}C yr BP.

In summary, one cannot presume to understand the caribou-hunting patterns of Paleoindian peoples without a detailed examination of the environmental, geographic, and hydrological features in existence during any specific

regional Paleoindian subperiod. I do not deny that large seasonal or annual subsistence movements almost certainly occurred but only that, whatever the seasonal prey or subsistence resource, movements were planned, attuned to a variety of environmental niches variably hosting different flora and fauna (potentially including marine fauna), and little if any "wandering" was involved. Uninformed opportunism was almost certainly welcome (Jarvenpa and Brumbach 1983), but it could not have been a strategy to ensure survival. I contend, then, that exploitation of some combination of marine mammals, fish, and faunal, floral, and avian resources supported by the Champlain Sea was a potentially integral feature of Paleoindian subsistence.

Moreover, the overall importance of caribou and other subsistence resources to Paleoindian groups, and the strategies by which and the seasons within which they were procured, almost certainly varied over the course of the Paleoindian period, though within shorter time scales caribou procurement strategies were likely significantly regularized. Indeed, despite the recognition a long time ago that the span of the broader Paleoindian period likely equates to several thousand years, models of settlement, subsistence, and procurement often compress this span and researchers construct arguments that assume "pioneer settings" (Meltzer 1989:19), "landscapes devoid of people or . . . with extremely low population densities" (Meltzer 1989:19), or an "impoverished . . . food base" involving big game (Meltzer 1989:15, paraphrasing Hayden 1982; see Deller 1989; Wright 1989). Yet, except perhaps for the earliest entrants into the region (Bradley et al. 2008; Gramly 1982; MacDonald 1985; Spiess et al. 1998), many of these assumptions are largely untenable. Rather, over time, Paleoindian populations grew and groups likely became increasingly aware of the landscape around them, its parameters and even many of its potential changes. In short, the landscape became increasingly historicized and enculturated (Ingold 1993).

Many people have warned against the injudicious use of ethnographic analogy in models or formulations of Paleoindian lifeways (Levine 1997; Loring 1997; see Wylie 1988). Nevertheless, the commonalities between the settlement patterns of the Athapaskan southern Chipewyan (Dene) (Brumbach 1997; Brumbach and Jarvenpa 1989; Jarvenpa 1980; Jarvenpa and Brumbach 1983, 1988), Algonquin Cree (Rogers 1963; Tanner 1979), Innu (Fitzhugh 1972; Loring 1997; Speck 1977; Turner 1899), Dogrib (Helm 1968), and Labrador Inuit to a lesser degree (e.g., Jordan 1977; Taylor 1977; Taylor and Taylor 1977) suggest that a multitiered settlement system involving base camp concentrations, logistical or staging communities, and hunting encampments was a common or even "natural" settlement or "socio-territorial" (sensu Chang 1962) system among boreal forest groups (Jarvenpa and Brumbach 1988; see Binford 1980). Thus, an exploration of the settlement patterns of these groups may have some applicability to Paleoindians in a general sense.

Jarvenpa and Brumbach (1988:612) write:

> It is an organization that allows rapid concentrations and dispersions of people over large areas and, simultaneously, fluid reshuffling of personnel through bilateral linkages. Such flexibility, no doubt, became adaptive in subarctic environments where local shortages of major food resources . . . were recurrent and often unpredictable, and where the stress of periodic starvation and labor shortages could be diminished by quick movements of people and goods. Many of these features have been central to hunter-gatherer social ecology elsewhere. . . . concentration-dispersion patterns and reciprocal access to resources are exhibited by hunter-gatherers in a wide variety of environmental and colonial settings around the world.

I suggest that some version of a multitiered socio-territorial system, broadly construed, pertained to at least some Paleoindian groups. At this point, it is not possible to suggest anything specific, except that concentration-dispersal patterns may explain some of the variation observed within regional Paleoindian sites of the same subperiod in the region and also may explain some changes over time.

As to the implications of such a model, versions of which have certainly been suggested before in Paleoindian contexts (e.g., Gardner 1994; Hester and Grady 1977; Spiess et al. 1998), perhaps foremost is the recognition that there was little if ever any "wandering," and that regions, subregions, or "territories" were potentially well known to Paleoindian groups, if not individually then collectively.

These ranges or "territories" were not defended but rather historicized and enculturated, so that certain bands were intimately linked with a certain portion of the landscape.

The hunting forays of the southern Chipewyan, for instance (and the Cree and Innu in an analogous manner), collectively encompass large portions of the landscape, but only a portion of the total range of the total band is used in any given year by any particular hunting group (Brumbach and Jarvenpa 1988; Fitzhugh 1972; Jordan 1977). Women, children, and the elderly move from the summer aggregation area to the winter staging or community area (see Tanner 1979, for a Cree example), which itself constitutes a dispersal of the larger aggregated band across the landscape, but then remain at the winter staging area while small groups of male hunters further disperse into separate winter hunting territories (Brumbach and Jarvenpa 1988). In the case of some ethnographically documented groups, aggregations were timed to correspond to caribou migrations, in part because these were times of food surplus and in part because the massive amounts of dispatched game needed immediate processing in order to be properly utilized, stored, and converted into usable products (Loring 1997; Spiess 1979). In the case of the southern Chipewyan, however, the hunting of woodland caribou occurred during the winter hunting forays, and caribou was but one species (albeit a critical one) procured during those trips.

Ethnographic research suggests that when periodic food shortages occurred, as they certainly did, this was much less often a case of not knowing where the resources were than of the resources not appearing at predetermined locations or ranges (Jarvenpa and Brumbach 1988). Indeed, the ethnographic literature on boreal forest hunting peoples is replete with references to rituals, taboos, and other practices that involve the pacification of animal spirits in order to ensure that food resources reappear the following season (Loring 1997; Speck 1977; Tanner 1979; Turner 1899). In the cases where game or other food resources did not manifest for whatever reason, groups would often turn to their neighbors, with whom they had previously established webs of social integration and accrued social obligations (Hayden 1982; Ingold 2004; Mauss 2000; Wiessner 1982) for help, and hope for the return of the resources the following season. Although the ethnographic literature is much less focused on long-term processes, if resources did not return during consecutive years it is likely that socio-territories would be reoriented to subsume more productive locales

The fur trade has long been recognized as a cause of significant disruption and distortion to the traditional hunting practices of subarctic or boreal forest Native groups (Leacock 1954). That is certainly true, but as Loring (1997) notes, one critical component of this disruption was the alteration of traditional subsistence rounds that relied at least in part on marine or freshwater aquatic resources during at least one season of the year (Fitzhugh 1972). Indeed, a fully interior, terrestrial subsistence-settlement regime is very rare among ethnographically documented subarctic hunter-gatherers, and of those cases most were made possible (willingly or not) only by the imposition of a market economy and the insatiable demand for furs. Thus, suggesting that Paleoindians groups (of whatever subperiod) likely traveled to the Champlain Sea for food resources is not a radical departure from ethnographically derived socio-territorial models. Rather, it potentially more accurately accommodates them.

CONCLUSIONS

The picture of Paleoindians in the Far Northeast may be less extreme and more nuanced than many traditional models of their subsistence and settlement have allowed, particularly as time progressed from the beginning of the period. Although caribou was undoubtedly an important resource, and likely constituted an important subsistence base, their procurement was likely regimented and was also likely augmented with other resources available in a variety of locales during different seasons, including the marine areas of the Champlain Sea.

This chapter presents information that demonstrates the existence of the Champlain Sea during most or all of the broader northeastern Paleoindian period and more tentative evidence that Paleoindians were coming to the sea on a seasonal or other periodic basis to exploit marine resources or the biotically productive locales fostered by the sea's existence, particularly estuary features.

By evaluating the range of environments, sites types, and site locations documented throughout the broader Paleoindian period in the Northeast, we may begin to construct more accurate and nuanced models of regional Paleoindian

subsistence and settlement. It is hoped that this chapter contributes a small part to those emerging models.

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CHAPTER XI

Late Pleistocene to Early Holocene Adaptation

The Case of the Strait of Quebec

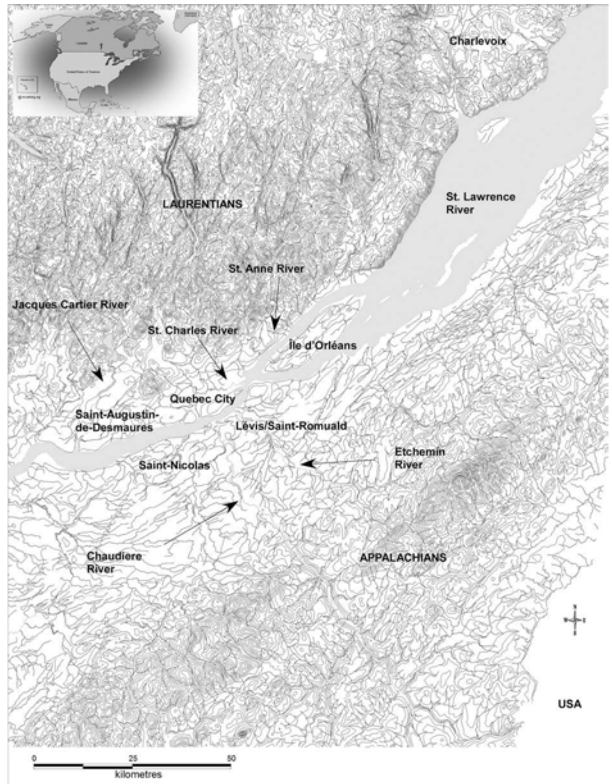
Jean-Yves Pintal

Until recently, indeed less than a decade ago, Quebec archaeologists were puzzled by the fact that their neighbors in southern Ontario, the Maritimes, and northern New England were excavating 12,000–10,000 cal BP sites while they were still dealing with a 9000 cal BP sequence of aboriginal occupation. For a while it was thought that environmental conditions may not have allowed such an early human presence in Quebec (Chapdelaine 1985:3). After all, the last remains of the glacier melted in central Quebec around 6500 cal BP (Dyke et al. 2004; Richard and Grondin 2009). Vast areas of the St. Lawrence lowlands were covered by large bodies of water, namely the Goldthwait and Champlain seas, between 13,100 and 10,600 cal BP, and Lampsilis Lake or a fluvial corridor between 10,600 and 8000 cal BP (Dionne 1972; Richard and Occhietti 2005).

Consequently, Quebec's chronological sequence did not include any Early Paleoindian sites. Late Paleoindian was represented only by the Ste. Anne/Varney point variety of the Eastern Plano tradition (Benmouyal 1987; Chalifoux 1999a; Chapdelaine 1994; Dumais 2000; Pintal 2006a), and the Early Archaic (10,000–9000 cal BP) was poorly understood, since sites from that period had been found only on the lower North Shore of Quebec (Pintal 2006b).

As research progressed on the paleoenvironment, it became evident that there was no reason why aboriginal people could not have reached parts of the province of Quebec by at least 11,000–10,500 cal BP (Dumais and Rousseau 2002a). Most of southern Quebec was ice free at that time and, even though the level of the St. Lawrence River was much higher than it is now (over 150 m higher in places), attractive drylands, sometimes forming descending terraces, were available along the shores of the ancient seas (Richard and Grondin 2009). By the early 2000s, it became evident that it was just a matter of time before archaeologists could demonstrate that aboriginal people were present in Quebec during the late Pleistocene (Dumais and Rousseau 2002a). In fact, at least one Early Paleoindian site was discovered recently in the Mégantic area, in southeastern Quebec (Chapdelaine 2004, 2007; see Chapdelaine, this volume). This discovery indicates that the presence of the glacier a few hundred kilometers north did not restrict Early Paleoindian occupation, suggesting that additional sites from this period will eventually be found in other parts of the province.

In this chapter I propose that some early Holocene sites, representative of the early Late Paleoindian period, may also be present in the Quebec City area. Moreover, new findings



11.1. General map of the study area around Quebec City.

and the reanalysis of existing collections, some of which were excavated in the 1960s, indicate that Late Paleoindian points in the province of Quebec display more variety than just the Ste. Anne/Varney style; their variability appears to be in line with that identified elsewhere in the Northeast. Finally, Early Archaic corner-notched points have also been found in the Quebec City area, demonstrating that the initial sequence of occupation in this region is similar, at least for this part of the Early Archaic sequence, to that seen elsewhere in the Northeast.

Most of the sites presented here were found in the Quebec City area—a fact that led to the following observation, which prompted this chapter. The significant concentration of early Holocene sites appears to be correlated with aspects of the region's marine paleoenvironment. As a result, ancient landscapes and environmental conditions must be taken into consideration if we are to understand the presence of Paleoindians in this part of Quebec.

Above all, this chapter presents for the first time a set of data related to the earliest arrival of aboriginal groups along the St. Lawrence. At present, the question of how Paleoindians adapted to this region can be addressed only by referring to settlement patterns and changes through time in the ways they used the different landscape units of this marine/littoral environment. Researchers still have to confirm the chronology of these sites by means of confident radiocarbon-dated sites and to relate the occupations to the various archaeological horizons used by archaeologists in the Far Northeast.

GEOGRAPHIC SETTING

The landscape of the Quebec City area has been heavily transformed since French explorer Samuel de Champlain established his *habitation* there more than four hundred years ago. The outstanding archaeological richness of this urban area, with a population approaching one million, is confirmed by the fact that several dozen aboriginal sites have been found so far, and sites continue to be discovered on a regular basis. The wealth of sites in the Quebec City area can be explained by several factors, some of them environmental. The landscape is dominated by the St. Lawrence River and its numerous tributaries, as well as by the junction of the river with its estuary. Aboriginal groups could thus have taken advantage of both the estuary's resources and the river's natural riches without having to travel long distances (figure 11.1).

The region is also remarkable for the number of nearby rivers that flow into the St. Lawrence (Chaudière, Etchemin, Saint-Anne, Saint-Charles, Cap-Rouge, Jacques-Cartier, etc.). This makes Quebec City the focal point of a vast river system covering a large portion of the province both to the north and to the south and, of course, given the orientation of the St. Lawrence, to the east and west.

The Quebec City area is dominated by high cliffs along the St. Lawrence. This means that smaller rivers descend abruptly before flowing into larger ones. Therefore, the rivers in the region frequently have falls or rapids at their mouths. Such features favor an abundance of birds (geese and ducks) and aquatic species (notably eels and a large variety of fish, including salmon). As well, broad tidal flats extend intermittently along the shore, constituting ecological transition zones that are ideal for certain fauna and flora.

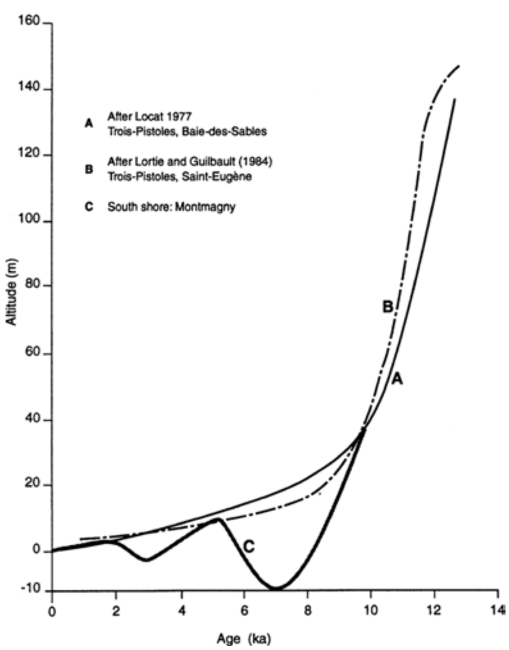
Quebec City sits between two mountain ranges: the Appalachians, dating from the Paleozoic era, and the Laurentians, formed in the Precambrian. The Precambrian is characterized by hard stones, like granite, whereas the Paleozoic is distinguished by soft stones such as schist, limestone, and chert. Several places in the Quebec City area have outcrops of chert, which is usually of siliceous and schistose aspect and varies in color from light to dark beige-brown to light to dark green. Petrographic analyses of waste flakes found on most of the excavated sites suggest that the lithics are of local origin, but no quarries have been identified to date (Morin 1997).

The region's elevation is the result of uplift after the retreat of the last glacier (Dionne 1988; and see figure 11.2). Therefore, extensive fluviomarine and marine terraces have shaped the landscape. Some of these terraces extend along the present coastline; others are perched higher up, clinging to the foothills. In most cases these terraces are composed of well-drained silty sand, making them desirable locations for campsites. This is important, since it means that the oldest archaeological sites are sometimes perched at higher altitudes and located at some distance from current bodies of water. It also means that few of them were flooded by the waters of the St. Lawrence, with the result that many remain accessible, despite being buried.

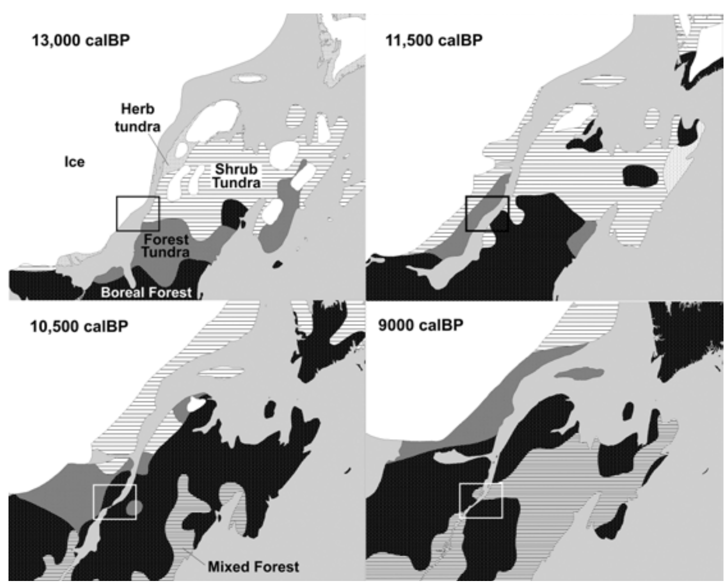
LATE PLEISTOCENE TO EARLY HOLOCENE PALEOENVIRONMENT

When the glacier started to melt 13,000 years ago, the appearance of this area was totally different from what it is now. At first, an ice barrier separated the salt water of the Goldthwait Sea east of Quebec City, which at the time was already a rich marine environment, from the fresh water of Lake Candona. When the ice barrier melted (Richard and Occhietti 2005), Lake Candona was rapidly replaced by salt water from the Champlain Sea (figure 11.3).

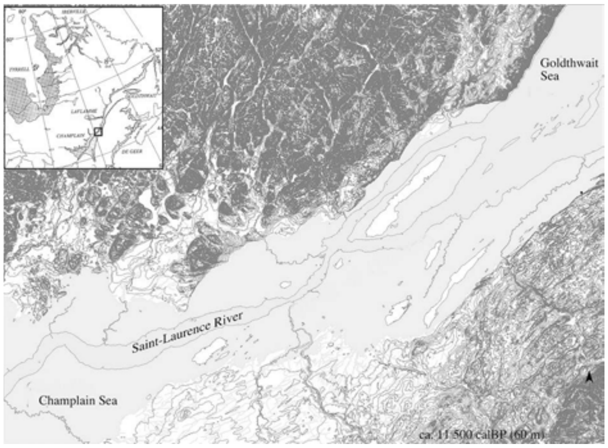
The Goldthwait Sea is relatively easy to understand from an environmental standpoint because most of the fauna associated with this postglacial body of water are still present today or at least were so when Europeans arrived in the Gulf of St. Lawrence (Dionne 1977). However, the situation is quite different for the Champlain Sea. Faunal evidence indicates that between 13,100 and 10,600 cal BP the Champlain Sea, whose waters were still cold, salty, and relatively deep, attracted numerous whales (mainly belugas), walrus, seals, fish, and seabirds (Newby et al. 2005; Richard and Grondin 2009; Richard and Occhietti 2005). However, this inland sea, although in contact with the salt water of the Goldthwait Sea, received a large amount of fresh glacial and continental water, and by 11,000 cal BP the



11.2. Holocene relative sea-level fluctuations in the St. Lawrence estuary (Dionne 1988).



11.3. Paleovegetation maps of Quebec, 13,000–9000 cal BP. Rectangle indicates Quebec City area (Dyke et al. 2004).



11.4. Strait of Quebec, circa 11,500 cal BP. Champlain and Goldthwait seas are in gray.

fauna described above was found mostly in the eastern half of this body of water, while the western half was undergoing a transition to a more lacustrine environment (Cournoyer et al. 2006; Harrington and Occhietti 1988; Hillaire-Marcel 1980; Occhietti et al. 2001; Richard and Occhietti 2005).

In some respects, the Champlain Sea might be considered an estuary in the Quebec City area. By 11,000 cal BP, after isostatic rebound and the westward influx of fresh water, its estuarine waters had slowly shifted toward the Quebec City area, where marine conditions persisted for another 2,000 years. This phenomenon can be attributed mainly to a late influx of salt water favored by the strong tidal currents that prevailed in the Strait of Quebec.

At the beginning of the Holocene, around 11,400 cal BP, the Strait of Quebec was about 40 km long and 10 km wide and was dotted with numerous elongated rocky islands. The strait shrunk to its present size in the wake of isostatic rebound. Île d'Orléans is the last vestige of this old archipelago (figure 11.4).

Paleoenvironmental research has demonstrated that the marine fauna of the Strait of Quebec was extremely rich—richer, in fact, than anywhere else in the Champlain Sea. The fauna was typical of a boreal-arctic marine environment. Whales, walrus, seals, fish, and seabirds were abundant mainly because of the high marine productivity caused by the blending of fresh and salt water. The presence of a 50 m deep trench at the mouth of the Chaudière River might have favored an upwelling process, and this may explain why the blending was so intense in the area.

After the Champlain Sea had been replaced by Lake Lampsilis or possibly a fluvial corridor around 10,600 cal BP, the Strait of Quebec was still a rich maritime environment. As has already been demonstrated (Laliberté 1992a; Pintal 2006b), aboriginal people were hunting seals around 9000 cal BP in this area. Moreover, the radiocarbon date obtained from site CeEv-5 (10,000 cal BP) shows that aboriginal groups were present in this strait when the main resources consisted of a typical boreal-arctic fauna (Pintal 2003).

The terrestrial environment of the Quebec City area underwent dramatic changes over this period, as the vegetation evolved from shrub tundra (12,500 cal BP) to open spruce woodland (9000 cal BP) (Richard and Grondin 2009). When paleoenvironmental reconstructions are examined, an interesting characteristic of the Quebec City area emerges: for more than 3,000 years the vegetation was structured mostly like a mosaic, producing a patchwork of different environments, whereas farther south and west a vast relatively uniform ecosystem was in place.

Moreover, when more specific environments are considered, as in the case of the research done at site CeEv-5 (Bhiry and Gendron 2003), the reality seems to be even more complex. Indeed, environmental reconstructions based on pollen data collected on or near this site show that no vegetation covered the area of occupation. Thus, if spruce-*Cladina* colonized the region around 11,000 cal BP, it would have been limited to certain suitable areas; elsewhere, the landscape would have been a mosaic of bare soil, mosses, and lichens. The various ecological zones were not just "latitudinally compressed"; they also consisted of parcels, separated from each other, with no relation to their current definition. This can be partly explained by the fact that the Quebec region is wedged between two mountain ranges, one of which, the Laurentians, maintained a cold environment for millennia after deglaciation (Richard 1977). Another reason is that strong winds were probably blowing in the Strait of Quebec, limiting the growth of vegetation in the most exposed areas.

Some paleoenvironmental reconstructions based on cores obtained from peat bogs near archaeological sites support the image of a sympatric vegetational cover that would definitely have affected the structure of the terrestrial fauna (see Kelly and Todd 1988). Therefore, in the Quebec City

area, the maritime environment appears to have been more stable than the terrestrial one during this interval.

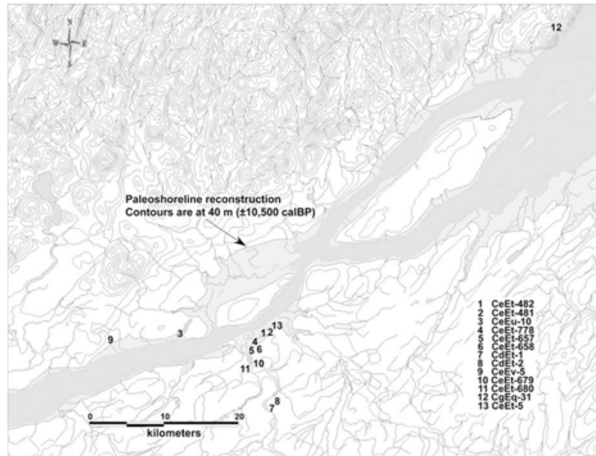
HISTORY OF ARCHAEOLOGICAL RESEARCH

The quest for the discovery of an Early Paleoindian site in the province of Quebec has been a long one, marked by many hypotheses but few conclusive results (Chapdelaine 1985, 2004; Lasalle and Chapdelaine 1990). Curiously enough, in light of recent discoveries it can now be said that archaeological research in the Quebec City area has always pointed to the likelihood of early occupation. Indeed, several scholars raised the possibility in field reports but without any clear conclusions, even though in some cases they had uncovered artifacts obviously related to early Holocene occupations (Gaumond 1968; Laliberté 1992a, 1992b, 1992c, 1992d; Taillon 1990, 1991).

Small-scale excavations started in the Quebec City area in the early 1960s, and this pioneering work was soon followed by surface finds and large-scale excavations. Over the next four decades, several dozen Late Archaic and Woodland sites were discovered, and it became evident that the region was a much-favored spot for occupation between 6000 cal BP and the early seventeenth century, when European colonies were established.

The hypothesis of a late Pleistocene/early Holocene occupation of the Quebec City area dates from the 1980s. While excavating Late Archaic sites in Saint-Augustin-de-Desmaures (CeEu-10), west of Quebec City, and in Lévis (CeEt-481) on the south shore of the St. Lawrence (figure 11.5), archaeologists uncovered a variety of artifacts that suggested the presence of older occupations. It was proposed at the time that some of these artifacts were similar to the Ste. Anne/Varney style of Plano points found in the Gaspé Peninsula by Benmouyal (1987) or to other point styles recovered in the Strait of Belle-Isle by McGhee and Tuck (1975) (Badgley and Boissonnault 1985; Laliberté 1993).

Laliberté (1992a, 1992d) found about 30 small quartz scrapers on site CeEt-482 located in Lévis. He noted their similarity to scrapers found by Gramly (1985) on the Early Paleoindian Atkins site. However, the radiocarbon dates Laliberté obtained made it difficult to argue that the styles of these two artifact assemblages were related, since the



11.5. Locations of the archaeological sites mentioned in this chapter in relation to the Strait of Quebec, circa 10,500 cal BP.

CeEt-482 site dates from around 9000 cal BP (7590 ± 220 ^{14}C yr BP, Beta-47744; 7990 ± 80 ^{14}C yr BP, Beta-40342; 8250 ± 200 ^{14}C yr BP, Beta-47745) whereas the Atkins site is coeval with Vail and should date to around 12,500 cal BP (10,500 ^{14}C yr BP). Even so, Laliberté was the first to suggest that aboriginal groups were present in the Quebec City area during the early Holocene and that artifacts of that period were made mostly by flaking quartz, although exotic chert was used occasionally as well. Nevertheless, questions remained: How old were the Plano-like points found in this area? Was there a link between these types of points and the quartz assemblages?

Work carried out over the past decade, mostly in the context of impact assessment studies, has not only enabled us to address these questions but also led to the discovery of several sites that demonstrate the presence of aboriginal people in the Quebec City area during much of the early Holocene (Pintal 1999b).

DATA SETS: INITIAL PHASE OF THE LATE PALEOINDIAN

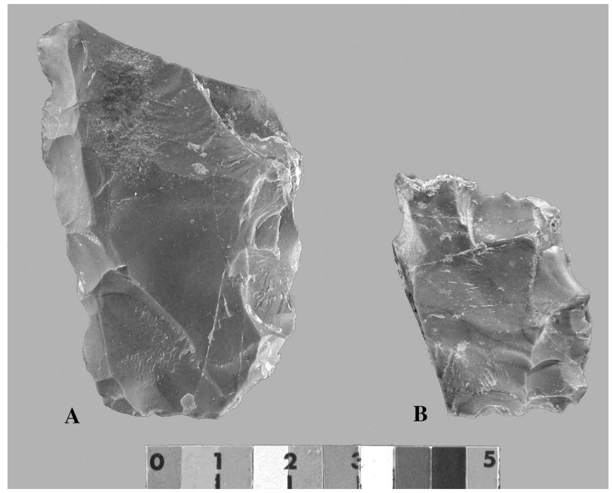
For Quebec archaeologists, the term "Late Paleoindian" usually brings to mind the classic lanceolate parallel-sided Plano points like the ones found on Thompson Island and on the Lower St. Lawrence–Gaspe Peninsula, where they are now referred to as the Ste. Anne/Varney type. However, reanalysis of work done in the early 1990s, coupled with new finds in the Quebec City area, indicates that the vari-

ability of points associated with the Late Paleoindian period in the province is greater than originally thought.

Based on geographic location, stratigraphic evidence, and diagnostic traits, sites CeEt-657, -658, and -778 are thought to represent the oldest aboriginal occupations in the Quebec City area (Pintal 1997, 1999a, 2002, 2005). The three sites are located on the south shore of the St. Lawrence, 200 m east of the Chaudière River and about 750 m south of its mouth. Artifacts were found on top of a rocky hill about 53 m above current sea level. The regional sea level emergence curve indicates that the 50 m level became free of water around 11,200 cal BP (Dionne 1988), but if the amplitude of the tide at that time (5–10 m) is taken into account, the summit of this rocky hill could not have drained until five hundred to one thousand years after that date (Occhietti et al. 2001). The three sites are no more than 100 m apart; two of them have a southern exposure, and the third, sitting in the middle of what is today a hardwood forest, does not open onto any direction in particular.

Site CeEt-658 has been partially destroyed by road construction. Nevertheless, it appears to be a small site, covering a surface area of 30 m^2. It has yielded about 2,000 flakes, mostly of the green-beige schistous variety that is abundant on prehistoric sites in the Quebec City area, although the exact location of the source of this stone remains unknown. The average weight of these flakes is 2.4 g, which, considering the presence of hammerstones, cores, and biface fragments, suggests that some primary flaking or biface thinning took place. The 20 tools recovered are limited in variety to triangular endscrapers and various sidescrapers, spokeshaves, and utilized flakes.

Site CeEt-657 covers about 100 m^2. Two occupational levels have been identified. They were separated by an intense but brief fluvial event that buried the first occupation under a layer of coarse sand and small cobbles. Artifacts from the deepest level were found in or on top of a layer of fine marine sediments. These objects were concentrated in the western half of the site, where about 4,000 flakes of green-beige schistose chert were recovered. This debitage reflects the same kind of technological activities as those observed on the previous site, that is, secondary flaking and biface thinning. Among the 21 tools associated with the first occupation is a curated pentagonal or leaf-shaped plano-convex biface with one fluted face (figure 11.6A). It could also have been used as a perforator or a beak. A heavily curated one-face fluted knife was also uncovered, but it had been reused to the point that it was no longer diagnostic (figure 11.6B). Among the other tools were several unifacial knives, mostly leaf-shaped with convex bases, and triangular or trapezoidal scrapers.



11.6. “Fluted” biface (A) and knife (B) from site CeEt-657, lower occupation level.

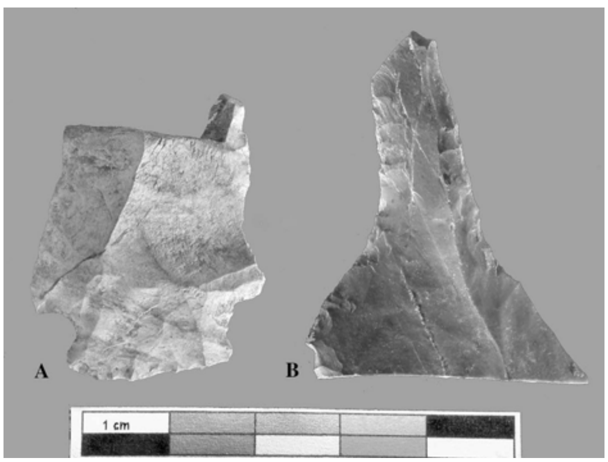
The fluvial event that buried the first occupation under a layer of coarse sand and small cobbles could be the Chaudière River overflowing its banks as a result of a spring ice jam; even today, this river is well known for its huge spring floods (Bhiry and Gendron 2006).

The upper occupational level was associated with a thin deposit of fluvial sediments that covered the fluvial event layer. Although artifacts were found over most of the site's 100 m^2, they were concentrated mainly in the eastern half. This sector contained about 5,000 flakes of a gray-beige chert whose origin remains unknown. In comparison with debitage from the preceding occupation, these flakes were smaller and testify to secondary flaking or biface edge thinning. A corner-notched point with an irregular convex base was recovered (figure 11.7A), as well as a few leaf-shaped knives, their convex bases having been thinned by the removal of a small flake. Various scrapers, sidescrapers, and a drill or borer (figure 11.7B) complete the assemblage.

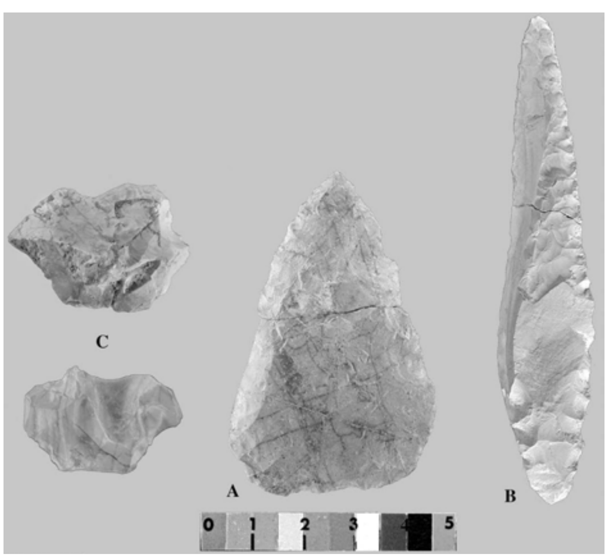
Site CeEt-778 is about the same size as CeEt-658 and has produced a similar quantity of flakes, reflecting the same kind of technological activities. However, twice as many tools (about 40) were uncovered, and their variety suggests

a complex occupation. Tools include a leaf-shaped point thinned by the removal of a long, wide, and flat (channel?) flake that covers more than two-thirds of one face of the blade (figure 11.8A, table 11.1). This object had apparently been heavily curated and may even have broken while one face was being beveled. Other tools are a bipointed flaked drill made from a twisted flake (*éclat torsadé,* figure 11.8B), several mostly rectangular scrapers, numerous spokeshaves, and two gravers (figure 11.8C).

Close to 90 percent of this undisturbed site has been excavated, and the artifact distribution is quite revealing. The artifacts were concentrated within a nearly perfect oval, suggesting the perimeter of a dwelling. If this were the case, the habitation would have had an oval floor measuring 6.5 m in length along a northwest-southeast axis and 4.5 m in width. It should be mentioned that the excavated area yielded only a few cobble stones within the oval space, and test pits indicated that an abundance of such stones could be found directly outside the occupied area. This strongly suggests that the residents prepared the ground by leveling it and removing large stones before setting up their encampment.



11.7. Corner-notched point (A) and borer (B) from site CeEt-657, upper occupation level.



11.8. Point (A), drill (B), and gravers (C) from site CeEt-778.

The geographic and stratigraphic contexts of these sites suggest that they are early occupations: the three sites could be contemporaneous and as old as 10,500 cal BP. However, radiocarbon dates are still lacking to confirm this. The fluted bifaces from CeEt-657, with their apparent pentagonal shape, are too heavily curated to be diagnostic, so their exact place in the chronology of the Paleoindian biface remains imprecise. The biface from CeEt-778 may correspond to a reworked Cormier/Nicholas point (Bradley et al. 2008:146). Some diagnostic traits, such as the bipointed drill, the gravers, and the "fluted" pentagonal biface, exhibit links with artifacts associated with the last phase of the Early Paleoindian in the Far Northeast.

For now, it appears that the first peopling of the Quebec City area began during the initial phase of the Late Paleoindian period. Earlier occupations remain elusive at best, but one has to keep in mind that few archaeological surveys have taken place on the 60 m terraces where these earlier sites are most likely to be found.

DATA SETS: LATE PALEOINDIAN/ EARLY ARCHAIC

Compared to the above-described sites, which are located on what is today the fairly inaccessible summit of a high rocky hill, and in a stratigraphic context that suggests the proximity of a marine deposit, the following sites are situated in a quite different geographic context. They all lie on fluvial terraces, 25–40 m above current sea level and less than 100 m from a stream or river (see figure 11.5). In contrast to the three previously described sites, which were less than 100 m apart, these sites were found in diverse locations on both the south and north shores of the St. Lawrence in the Quebec City area.

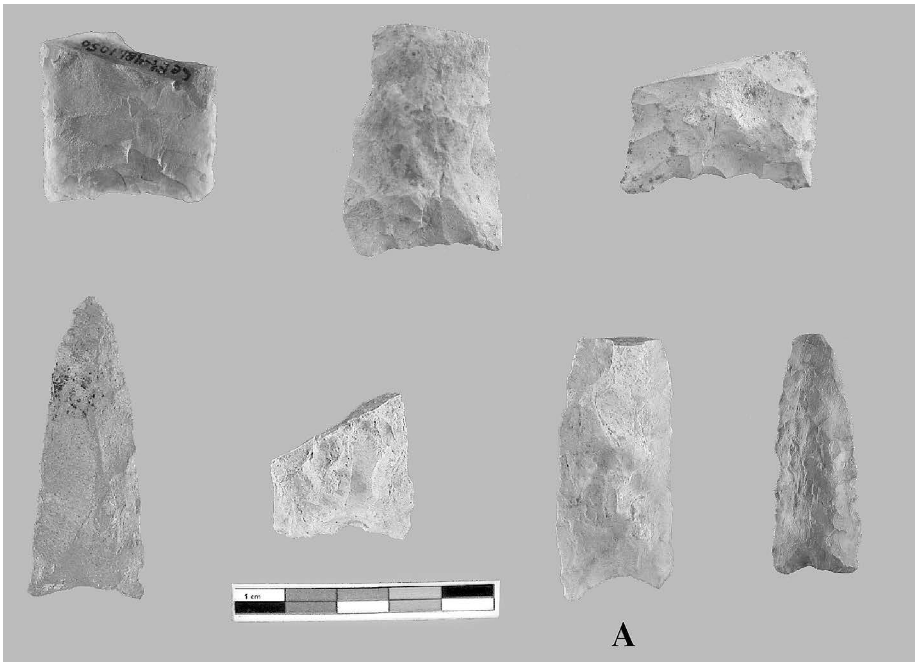
Most of the artifacts belonging to the following Late

Table 11.1. Main Attributes of the Most Complete Points, Quebec City Sites

Artifact No.	*Sequence**	*Length (cm)*	*Width (cm)*	*Thickness (cm)*	*Weight (g)*	*Basal modification (grinding)*	*Channel flake thickness*	*Channel flake length*	*Channel flake width*	*Depth of concavity*
CeEt-657-2.140	Phase 1	-	3.7	1.0			0.1	-	2.1	
CeEt-657-2.147	Phase 1	-	-	0.6	-		0.2	-	-	
CeEt-778.90-100	Phase 1	6.4	4.1	0.8	7.5	moderate	0.1	4.9	3.1	
CeEv-5.433	Phase 2	5.4	2.1	0.6	20.0	moderate	0.1	1.5	0.8	0.1
CeEt-481B.111	Phase 2, parallel oblique	6.0	2.8	0.6	8.7					
CeEt-481B.109	Phase 2, oblique base	8.6	2.5	1.0	15.8					
CeEt-481B.139	Phase 2, concave base	-	2.6	0.6	-	moderate				0.3
CeEt-481B.137	Phase 2, concave base	-	-	-	-					
CeEt-481B.549	Phase 2, concave base	-	-	0.7	-	moderate				0.2
CeEt-481B.664	Phase 2, oblique base	-	2.0	0.6	-					
CeEt-481B.656	Phase 2, oblique base	3.6	2.0	0.5	2.5					
CeEt-481B.859	Phase 2, oblique base	-	2.4	0.9	8.9	moderate	0.1	0.8	1.8	0.1
CeEt-481B.869	Phase 2, concave base	-	2.8	1.0	-	moderate				0.2
CeEt-481B.1017	Phase 2, concave base	-	2.2	0.6	-	moderate				0.2
CeEt-481B.1050	Phase 2, concave base	-	2.3	0.6	-	moderate				0.2
CeEt-481B.1103	Phase 2, oblique base	6.3	2.3	0.6	9.4	moderate				0.2
CeEt-481B.1135	Phase 2, parallel oblique	4.6	2.1	0.9	6.6					
CeEt-481B.1159	Phase 2, concave base	6.3	2.4	1.4	19.0		0.2	1.0	0.7	0.4
CeEt-5.7	Phase 2B	4.4	2.1	0.6	4.6					

*See table 11.2.

Paleoindian and Early Archaic sites have been identified in the course of reanalyzing older collections, some of which were uncovered in the 1960s. A series of points was found at the base of the lowest level in the northern part of site CeEt-481, a 1,000 m^2 Late Archaic site (Laliberté 1993; Pintal 2007a). This site is located on a 24 m high terrace in Lévis, between the Etchemin and Chaudière rivers, about 300 m from the St. Lawrence River. Since the remains of these occupations are mixed with those of the Late Archaic ones, it has not yet been possible to determine the exact composition of the assemblages. The beige-green variety of regional chert was used for the most part, and primary



11.9. Lanceolate to leaf-shaped points with concave bases from site CeEt-481. A, deeply concave "fishtail like" point.

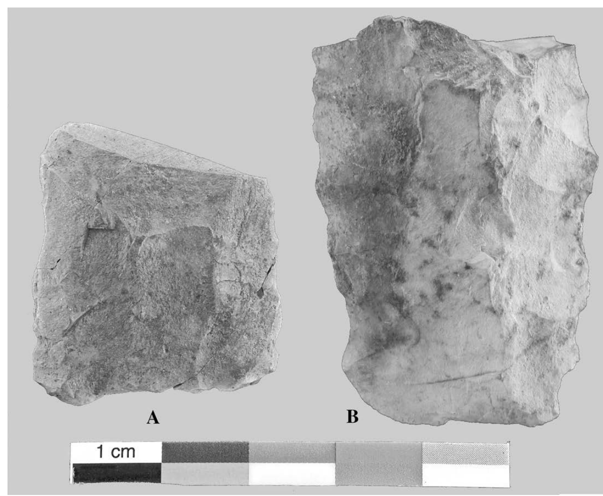
flaking or biface thinning took place. On the other hand, a variety of cherts, probably exotic in origin, can be observed among the points. Most of them are beige to pink and schistose in aspect. Though the majority of these artifacts were found in an area covering about 40 m^2, the distribution of all these artifacts covers close to 200 m^2, which gives some indication of the size of the occupational area.

Several different types of points can be distinguished among the two dozen that stand out in relation to the Late Archaic ones. One type is clearly differentiated from the others by its concave base (figure 11.9). Points of this type tend to be lanceolate with unpatterned surface retouch. The concavity of the base varies from shallow to pronounced, and small pointed ears are often present. Occasionally a short flute scar similar to basal thinning can be observed. One point differs slightly from this model: it is wider at the midpoint, and the base is deeply concave, showing some similarities with a fishtail base (figure 11.9A). In all cases, the base has been thinned by the removal of a few, usually short flakes, and the base has been only partially ground. This type of biface shows similarities with the Cormier type of the Cormier/Nicholas points of the Late Paleoindian period, previously called Nicholas/Holcombe (Bradley et al. 2008:149; Fitting et al. 1966).

A second type of point differs from the preceding in that its base is straighter and usually oblique, sometimes with a barb or a rounded ear on one side (figure 11.10). Two of these points are slightly different (figure 11.11). One is a square-based, leaf-shaped, probably lanceolate biface whose maximum width is at or above midpoint. The base was thinned on one side by the removal of a long and narrow channel flake, and the surface flaking pattern consists of shallow, almost parallel and oblique flake scars (figure 11.11B). On a second point the blade is more triangular and the proximal part was thinned by the removal of two parallel flakes. The base is slightly concave and irregular (figure 11.11A). Compared with the previously defined type, these bifaces seem more similar to the Nicholas type of the Cormier/Nicholas points (Bradley et al. 2008:149).

Points of a third type are totally different from the two previous ones. They are leaf-shaped with a clear, undulating, parallel oblique surface pattern (figure 11.12). The shape of the bases cannot be described because they are all missing, but side notches are clearly present on all of them. In some cases, the flaking of the blade forms a central ridge, and in others the ridge is absent, the blade having been thinned by outrepassé flaking. Other objects showing the same flaking pattern (figure 11.13) have been found on a terrace close to a series of rapids 15 km inland, on the Chaudière River (CdEt-1, CdEt-2; Taillon 1990, 1991). Although more comparisons remain to be done, this type shows similarities to the Plainville type (Jackson 1998,

11.10. (right top) Lanceolate to leaf-shaped points with oblique bases from site CeEt-481.



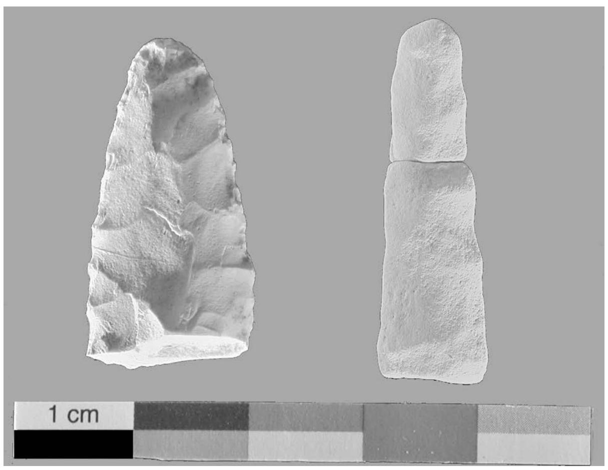
11.11. (bottom) Basally thinned points from site CeEt-481. A, base of a multiple fluted triangular point; B, lanceolate fluted point.

2004) or some of the Ste. Anne/Varney points (Benmouyal 1987; Bradley et al. 2008:156).

As mentioned above, determining the age of these occupations has been problematic. However, the discovery of site CeEv-5 has provided some insight into their age. This site is located on the north shore of the St. Lawrence, almost 3 km inland, on a fluvial terrace 100 m above current sea level (Pintal 2003, 2007b). Although it is now located in the middle of a hardwood forest, this occupation would have been oriented southward originally, because it stands on a south-facing slope. It covers about 100 m^2, 80 percent of which has been excavated. Close to 6,000 flakes, weighing a total of 21 kg, have been found, and most are of quartz. Their average weight (>5 g) combined with the presence of hammerstones and several cores suggests that some primary flaking took place. However, it is evident that in some areas knappers concentrated on thinning bifaces.

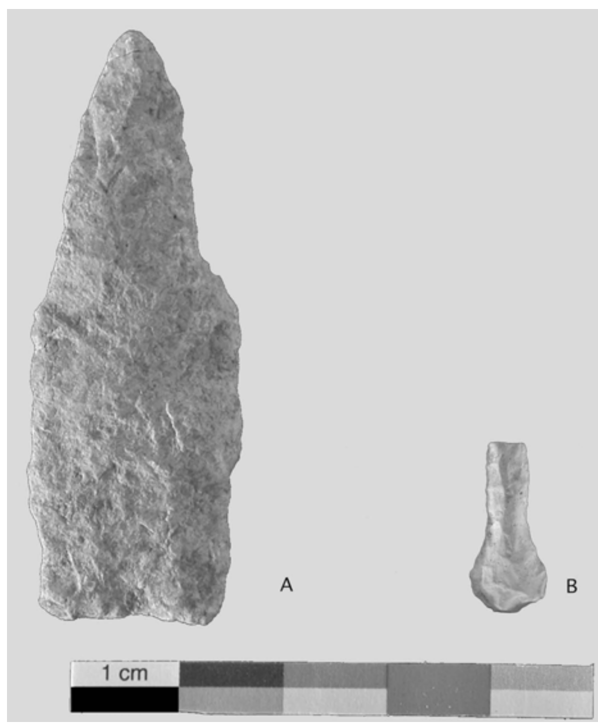
At least one hearth was identified. It consists of a small circular mound (50 cm wide and <10 cm thick) of reddish soil containing bits of charcoal, with a concentration of charred rocks 2 m to the south. Radiocarbon analysis has indicated that this site is about 10,000 years old (8890 ± 50 ^{14}C yr BP; 10,190–9860 cal BP, Beta-175063). Site CeEv-5 is now recognized as one of the oldest radiocarbon-dated sites in Quebec. Most of the tools and flakes found on it were situated within a 5 m radius of the hearth, which suggests that related technological activities took place inside a dwelling.

The fact that the quartz assemblage from CeEv-5 can be dated to 10,000 cal BP is not really surprising (Robinson 1992), although the same cannot be said about a point made of a rhyolite, possibly of New Hampshire origin (figure 11.14A). The base of this heavily curated point is square or slightly concave and has been thinned by the removal of a small channel flake covering about a third of the total length of the point. On the blade, the maximum width appears to be at midpoint, and the surface flaking pattern consists of shallow oblique parallel retouch. Other tools



11.12. (top) Leaf-shaped points with undulating parallel oblique surface patterns from site CeEt-481.

11.13. (left) Points or drills tips from sites CdEt-1 and CdEt-2.



11.14. Basally thinned point (A) and drill (B) from site CeEv-5.

from CeEv-5 include a drill of beige-green chert (rodlike, figure 11.14B) and some triangular or trapezoidal scrapers, as well as the usual sidescrapers and spokeshaves, all made of quartz.

The rhyolite point is similar in several aspects to the Late Paleoindian Cormier/Nicholas type, previously known as Late Paleoindian Holcombe/Nicholas (Bradley et al. 2008:146). This point type has been found in areas closer to Quebec, such as southern Ontario (Ellis and Deller 1990, 1997; Woodley 2004) and northern New England (Bradley et al. 2008; Ritchie 1957; Spiess and Newby 2002; Spiess et al. 1998), and artifacts of New Hampshire rhyolite have been uncovered in the Mégantic area of southern Quebec (Chapdelaine 2007).

The radiocarbon date obtained for CeEv-5, which has

yielded a quartz assemblage that should correspond to an Early Archaic component, along with a Cormier/Nicholas-like point, is now considered to provide an estimate of the minimal age of the Cormier/Nicholas points found in the Quebec City area. The fact that different point styles have been recognized at CeEt-481 may mean that it was reoccupied by different groups for a period of time or that variability existed among the Cormier/Nicholas point forms. For now, most of the points associated with CeEt-481 are thought to date between 10,200 and 9500 cal BP.

Sites from the same period are also found in southern Ontario and northern New England. The sites in the Quebec City area could thus be interpreted as proof of a territorial extension of the hunting grounds of populations from those regions. Furthermore, certain similarities between the Quebec City sites and the Ste. Anne/Varney sites of the Gaspé Peninsula could indicate links between the groups in these two areas (Benmouyal 1987; Wright 1982). Comparisons might also be drawn with some Paleoindian/Early Archaic sites found along the Atlantic coast, such as in New Jersey (Cavallo 1981), or in the Canadian Maritime Provinces and Gulf of St. Lawrence region (Keenlyside 1985a, 1985b, 1991; McCaffrey 1986).

The discovery of a Cormier/Nicholas-like point in a quartz assemblage may be interpreted in many ways, but it surely offers some insight into the transition between Late Paleoindian and Early Archaic. The point appears to have been maintained and even recycled for another function (drill?) before eventually being discarded on a site where knappers produced a large number of new quartz bifaces.

Even if this process—the transition between fine-grained materials to coarser ones—did not follow a simple linear progression, it is worth noting that in two different areas, namely, the mouth of the Chaudière River (CeEt-679 and CeEt-680; Pintal 1998, 2000) and the Charlevoix hills on the north shore of the St. Lawrence east of Quebec City (CgEq-31; Pintal 2004), terraces lying directly above those that yield mostly Early Archaic quartz artifacts have produced assemblages made of local chert and quartz. Therefore, even though the transition may not be linear, a trend is slowly emerging with each new find.

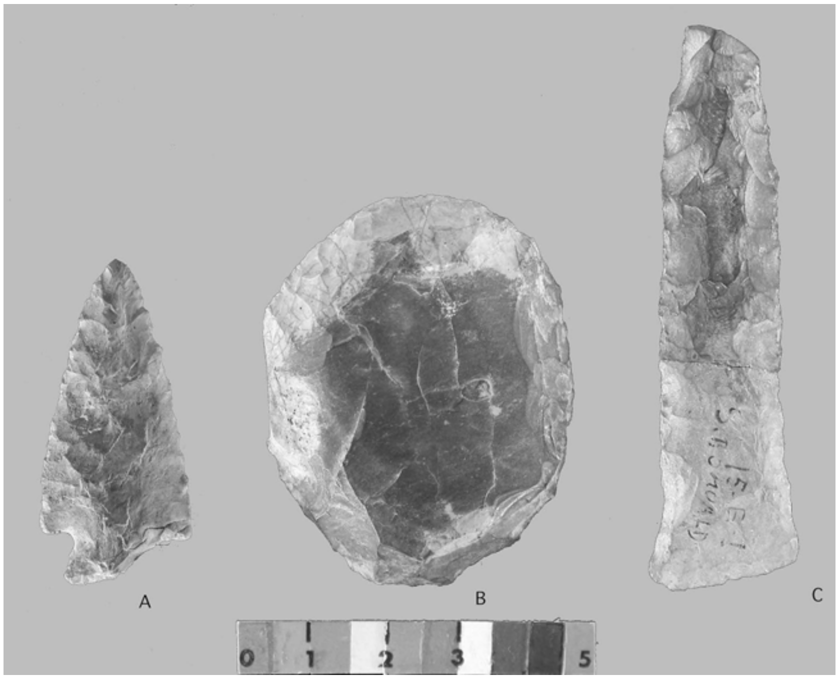
Whereas data collected in the Quebec City area are gradually providing some insight into the diversity of the so-called Late Paleoindian occupation of the area, data for the Early Archaic presence remain scarce at best.

Artifacts collected in the 1960s at site CeEt-5 in Saint-Romuald can now be related to the Corner-Notched horizon (Gaumond 1968). This site occupied a fluvial terrace that lies 20 m above current sea level and 200 m from the shore of the St. Lawrence River. Most of the artifacts collected at this site are of Late Archaic origin, but several are quite distinct. Among them is a triangular corner-notched point with slightly serrated sides (figure 11.15A). Other tools include thick, almost rounded scrapers (figure 11.15B) and a drill, or "rodlike" biface (figure 11.15C). These artifacts have been flaked from a high-quality gray-brown chert not usually found in the region. The assemblage may be coeval with the Nettling complex defined for southern Ontario (Ellis et al. 1990, Ellis et al. 1991).

The upper occupational layer of the CeEt-657 site also yielded a corner-notched point and a trianguloid biface (drill or borer). Similarly, a corner-notched point was uncovered at site CgEq-31, which was found on the north shore of the St. Lawrence on a 30 m fluvial terrace, 40 km east of Quebec City (Pintal 2004).

The age of these sites remains to be confirmed, but they are expected to date between 9500 and 9000 cal BP, or somewhat earlier than the 9000–8000 cal BP sites found in our study area and whose assemblages are slightly better known thanks to the work done by Laliberté in the early 1990s (Laliberté 1992a, 1992d). His 27 m^2 excavation at site CeEt-482 revealed a meter-long oval fireplace paved with charred rocks and containing burned bones identified as seal, bear, beaver, turtle, and a bird. Radiocarbon dates situate this site at about 9000 cal BP (7590 ± 220 ^{14}C yr BP, Beta-47744; 7990 ± 80 ^{14}C yr BP, Beta-40342; 8250 ± 200 ^{14}C yr BP, Beta-47745; (Laliberté 1992d). Nearly 2,000 flakes and 100 tools, mostly of quartz, were recovered, including a polished ulu-like knife in sandstone, numerous small scrapers and pièces esquillées, as well as some biface preforms. Most of this material was found around the hearth, suggesting the presence of an oval dwelling.

Other undated sites in the Quebec City region can be associated with the Early Archaic because they are located on 20–30 m high terraces, and their flaked stone technology is based mainly on quartz (CeEt-679a and b; Pintal



11.15. Corner-notched point (A), scraper (B), and drill (C) from site CeEt-5.

1998, 2000). Some of these sites cover less than 20 m^2, and some of the smaller ones have been interpreted as satellite sites related to domestic occupations, like that described earlier for site CeEt-482.

So far, most of the Paleoindian-like sites found in the Quebec City area are concentrated on the south shore of this urban center, at or close to the mouth of the Chaudière River. Clearly, some of these locations were visited regularly over the centuries—mainly by Late Paleoindians—a trend that explains, in part, the variability of the points discovered. In contrast to these Paleoindian sites, Early Archaic occupations are found in more diverse environments and do not appear to be as concentrated in specific locations. They are present in different landscapes, like small inner bays, fluvial terraces along the St. Lawrence, or close to rapids or small falls along the Chaudière River.

DISCUSSION

Though much work remains to be done in our study area before we understand and confirm the chronological sequence and cultural dynamics at work, one fact stands out: the variety of occupations suggests the presence of an old and lengthy occupational sequence.

The main goal of this chapter is to present the body of data acquired over the past decade in the context of impact assessment studies. Some radiocarbon dates, coupled with the correlation between the altitudes of the terraces where the sites were found and the sea level emergence curve, provide the basis for a preliminary chronological framework divided into four phases (table 11.2).

The few diagnostic artifacts associated with the proposed earliest occupations (Phase 1) are tentatively interpreted as representative of a transition process that took place at the end of the Early Paleoindian and involved the Cormier/Nicholas and Ste. Anne/Varney point forms. Most of the sites are small and appear to be workshop-habitations geared toward the production of hunting tools. Some of the artifacts discovered on sites CeEt-657, -658, and -778, like the twist-drill and the gravers, might suggest that the sites' occupants were involved in the interactive sphere that encompassed the Far Northeast, from southern Ontario to northern New England and the Maritimes.

The main new finding for the Quebec City area is the presence of a variety of Late Paleoindian Cormier/Nicholas points made, for the most part, of what seems to be regional chert. Points of this type had not yet been reported in the province of Quebec. However, some differences between the points from Quebec and their New England and Ontario counterparts are worth noting. The points

Table 11.2. Preliminary Chronological Sequence for the Late Pleistocene/Early Holocene Occupation of the Strait of Quebec

	Associated Site				
Phase 1 10,500–10,000 cal BP initial Late Paleoindian/early Cormier/Nicholas?	CeEt-657-2	CeEt-658	CeEt-778		
Phase 2A 10,200–9500 cal BP Late Paleoindian, Cormier/ Nicholas, Ste. Anne/Varney	CeEv-5	CeEt-481B	CdEt-1	CdEt-2	CeEt-70
Phase 2B 9500–9000 cal BP Early Archaic, Corner-Notched	CeEt-5	CeEt-657-1	CgEq-31		
Phase 3 9000–8000 cal BP Early Archaic, quartz assemblages	CeEt-482	CeEt-679	CeEt-680	CeEu-10	

in Quebec tend to be more triangular and are not fluted as frequently. Indeed, less than 25 percent display fluting. Further analysis may demonstrate that this "Lévis-style" point is actually a local variation or a later expression of the broader Cormier/Nicholas style. Note that none of these point types have been observed in later collections from the Quebec City area.

The age of the Early Archaic corner-notched points remains to be determined. The fact that most of these points have been found on terraces 20–40 m above current sea level suggests that they are correlated with the 9500–9000 cal BP interval. However, Ste. Anne/Varney-like points have also been uncovered at almost the same altitude and could be coeval. The chronology of this episode remains unclear, as does the exact nature of the relationship between the two types of sites with their different point styles. The raw materials associated with Corner-Notched sites (Phase 2B) are different from those associated with Phase 2A, the former yielding gray to brown siliceous material and the latter being mainly composed of "local" schistose beige, gray, or green chert. The presence of a Cormier/Nicholas-like point in a 10,000 cal BP quartz assemblage may be interpreted as a late expression of this horizon or may be due to the curation of this object probably made of New Hampshire rhyolite, an exotic material for the Quebec City area. The settlement pattern of Phase 2A and 2B sites remains poorly understood at best. Small task-specific camps have been recognized for both phases, but since no hearths were uncovered on them the presence of domestic camps has not been demonstrated.

Quartz assemblages, characterized by the use of small trapezoidal endscrapers, appear to date from 10,000 to 8500 cal BP in the Quebec City area. These assemblages often contain small quantities of chert, both local and exotic, and quartzite. Several sites belonging to this period have been found in different sectors of the surrounding landscape, suggesting that this region was already a preferred settlement location at the time. The presence of a dwelling is suggested on at least one site, since most of the artifacts were concentrated around a 1 m long by 10 cm thick oval hearth paved with burned rocks. The other sites appear to be small task-specific camps.

The majority of the sites presented here seem to be small camps covering less than 50 m^2, with fewer than 5,000 flakes and a few dozen tools. This is particularly true for Phase 1. In comparison, most of the recent sites (9000–8000 cal BP, Phase 3) tend to be larger and richer in terms of artifact content. Based on artifact spatial distribution, we suggest that a dwelling was present at sites CeEt-778 (Phase 1) and CeEt-482 (Phase 3). The two dwellings appear to have been oval in shape and approximately 6.5 m by 4.5 m. Only the latter site was found to contain a central fireplace.

With regard to location, the Phase 1 sites would have occupied the summit of a rocky island located in front of the

mouth of the Chaudière River. The Phase 2A sites were situated on exposed marine terraces along the shore, on inland terraces, and 15 km inland along the banks of the Chaudière River, close to rapids. The Phase 2B sites were found on exposed marine terraces along the shore, on what may have been an island, and at the back of inner bays. The Phase 3 sites occupied the same locations as those of Phase 2B but were more widespread, some being discovered in Saint-Augustin-de-Desmaures, near the first interior lake.

Faunal remains are scarce. Only one Phase 3 site has yielded any faunal material, and the remains point to the exploitation of diverse littoral fauna (seal, bear, beaver, turtle, and bird) at a time when the terrestrial environment had become more stable. The absence of caribou is interesting and could reflect seasonal variation; however, it might also be an expression of a different kind of adaptation. As has already been demonstrated for Early to Middle Archaic sites in the Strait of Belle-Isle, caribou was just one prey among others (walrus, seal, beaver, bird, etc.) available in this rich littoral environment (McGhee and Tuck 1975; Pintal 2006b). Archaeological findings from the lower north shore of the St. Lawrence show that aboriginal groups could have easily adapted to the kind of environment that prevailed in the Quebec City area more than 9,000 years ago (Pintal 2006b). The same can be said for the occupants of the Ste. Anne/Varney sites located on the north side of the Gaspé Peninsula (Chalifoux 1999b; Pintal 2006a). However, the total lack of faunal remains and the scarcity of data related to the spatial organization of these latter sites limit our interpretation.

The relatively long-term use of the Strait of Quebec discussed in this chapter occurred between 11,000 and 9000 cal BP, a period when the terrestrial environment of the Quebec City area was undergoing dramatic changes as the vegetation evolved from shrub tundra (12,500 cal BP) to open spruce woodland (9000 cal BP). Faunal remains collected on the paleontological site of Saint-Nicolas demonstrate that between 13,000 and 10,700 cal BP the marine and littoral environment of the Quebec narrows was composed of a rich and varied fauna, typical of a boreal-arctic environment. And, as indicated previously, sea mammals were hunted by aboriginal people around 9000 cal BP. Therefore, during this interval in the Quebec City area, the maritime environment appears to have been more stable than the terrestrial one. The working hypothesis proposed here is based on the assumption that this rich maritime environment explains why aboriginal groups were attracted to the region and why they appear to have continued to frequent it on a regular basis (see figure 11.5).

The suggestion that Paleoindian populations exploited maritime resources is not new. It has already been advanced for the Lake Champlain Basin (Loring 1980, 1997; F. Robinson, this volume), the Gaspe Peninsula (Chalifoux 1999b; Pintal 2006a), and the Atlantic provinces (Keenlyside 1991). However, the present hypothesis concerning the early human occupation of the Strait of Quebec does not imply that Paleoindians were sealers and whalers as well as caribou hunters, but rather that certain small and highly mobile groups of Late Paleoindians, already accustomed to exploiting marine or lacustrine environments, such as those in southern Ontario and Vermont, incorporated the Strait of Quebec and its rich maritime resources into their subsistence round. Considering the environmental and cultural data at hand, it will eventually be possible to demonstrate that late Pleistocene groups were exploiting, at least on a seasonal basis, resources from this bountiful marine environment.

It is also suggested that such opportunistic exploitation of marine resources characterized the subsistence and settlement patterns of some Early Archaic groups in the Quebec City area. However, Early Archaic exploitation of marine resources was likely embedded in a different settlement pattern, based on a more restricted seasonal round. Small task-specific camps were present, but so were larger domestic ones.

CONCLUSIONS

The Strait of Quebec, because of its quite uncommon context, may have been important in the development of a pattern of maritime/littoral exploitation that underlies the initial peopling of the province. A similar context also appears to have been a key factor in the later occupation of the north shore of the St. Lawrence River, where a maritime/littoral exploitation pattern has already been clearly identified (Early Archaic; Pintal 2006b), and possibly the later

occupation of the north side of the Gaspé Peninsula (Late Paleoindian; Chalifoux 1999b; Pintal 2006a).

This chapter presents data from sites that appear to date in some cases from the late Pleistocene but mainly the early Holocene. Their precise age and their relationship to the various archaeological horizons recognized in the Northeast still need to be defined. However, the links with Late Paleoindian Cormier/Nicholas and Ste. Anne/Varney artifacts are quite strong, and the 10,000 cal BP radiocarbon date obtained from site CeEv-5, which yielded a Cormier/Nicholas point, seems to provide a minimum estimate for the age of these occupations. Work still needs to be done before we can confirm that late Pleistocene sites are present, but we now know that this territory was suitable for occupation.

One also has to consider that these sites, contrary to those of the same time frame in Ontario and New England, need to be understood as occupied by pioneering groups entering a rather isolated region where a boreal-arctic environment still prevailed. Their exploitation of this new type of environment would not have produced assemblages similar to those reported from Ontario and New England, where Paleoindians had been firmly established for hundreds and even thousands of years. To resolve certain questions, it will be necessary to find more of these curiously located sites and, most of all, to identify and interpret artifacts not necessarily related to large domestic occupations, as the ones reported elsewhere, but to small seasonal camps focused on the exploitation of a wide variety of faunal resources, including marine ones.

This information along with data from an Early Paleoindian site in the Mégantic Lake area, which is connected to the study area by the Chaudière River (see Chapdelaine, this volume), clearly demonstrate that the province of Quebec's early prehistory is as old and complex as anywhere else in the Far Northeast, and that the marine-fluvial corridor of the St. Lawrence River appears to have been an attractive environment for Paleoindians. We still have to deal with a lack of radiocarbon dates and the fact that those obtained to date are somewhat younger than the proposed sequence for Ontario and New England. The same can be said for eastern Quebec Ste. Anne/Varney sites, which have provided much younger radiocarbon dates than the proposed interval in New England (Benmouyal 1987; Bradley et al. 2008; Chapdelaine 1994; Pintal 2006a). New territories of research are now open to Quebec archaeologists, but the frames of reference will clarify only when more of these early sites are located, excavated, and firmly dated.

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INDEX

Other PEOPLING OF THE AMERICAS publications:

Owsley, Jodry, Stafford, Haynes, and Stanford
Arch Lake Woman: Physical Anthropology and Geoarchaeology

Goebel and Buvit
From the Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in Late Pleistocene/Early Holocene Beringia

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Clovis Lithic Technology: Investigation of a Stratified Workshop at the Gault Site, Texas

THE FAR NORTHEAST, a peninsula incorporating the six New England states, as well as New York east of the Hudson, Quebec south of the St. Lawrence River and Gulf of St. Lawrence, and the Canadian Maritime Provinces, provided the setting for a distinct chapter in the peopling of North America. *Late Pleistocene Archaeology and Ecology in the Far Northeast* focuses on the Clovis pioneers and their eastward migration into this region, which was inhospitable prior to 13,500 years ago, especially in its northern latitudes.

Bringing together the last decade or so of research on the Paleoindian presence in the area, Claude Chapdelaine and the contributors to this volume discuss, among other topics, the style variations in the fluted points left behind by these migrating peoples, a broader formal disparity than previously thought. This book offers not only an opportunity to review new data and interpretations in most areas of the Far Northeast, including a first glimpse at the Cliche-Rancourt Site, the only known fluted point site in Quebec, but also permits these new findings to shape revised interpretations of old sites. The accumulation of research findings in the Far Northeast has been steady, and this timely book presents some of the most interesting results, offering fresh perspectives on the prehistory of this important region.

CLAUDE CHAPDELAINE, a professor of archaeology at the Université de Montréal, specializes in the prehistory of North America.

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